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Yanagihara et al. (43) Pub. Date: Sep. 19, 2002

(54) VIDEO RETRIEVAL AND BROWSING APPARATUS, VIDEO RETRIEVAL, BROWSING AND EDITING APPARATUS, AND RECORDING MEDIUM

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Publication Classification

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(52) **U.S. Cl.** **707/3**

(57) **ABSTRACT**

A thumbnail data having a time necessary for browsing display is extracted from a video file stored in a storage device in real time using query (cut point query, query by telop such as news, audio classification data, etc.), and then, high-precise thumbnail retrieval and browsing is carried out at frame unit and second unit. Further, high-precise segment playback by designating the thumbnail retrieval and browsing time as playback start/end points can be achieved without preparing a thumbnail data saving storage device. Therefore, it is possible to achieve high-precise thumbnail retrieval and browsing at frame unit and second unit without previously preparing and saving the thumbnail data. Further, it is possible to provide a retrieval, browsing and editing apparatus, which can effectively and accurately realize frame unit edit processing using the thumbnail retrieval and browsing, and to provide a recording medium recording the processing program.

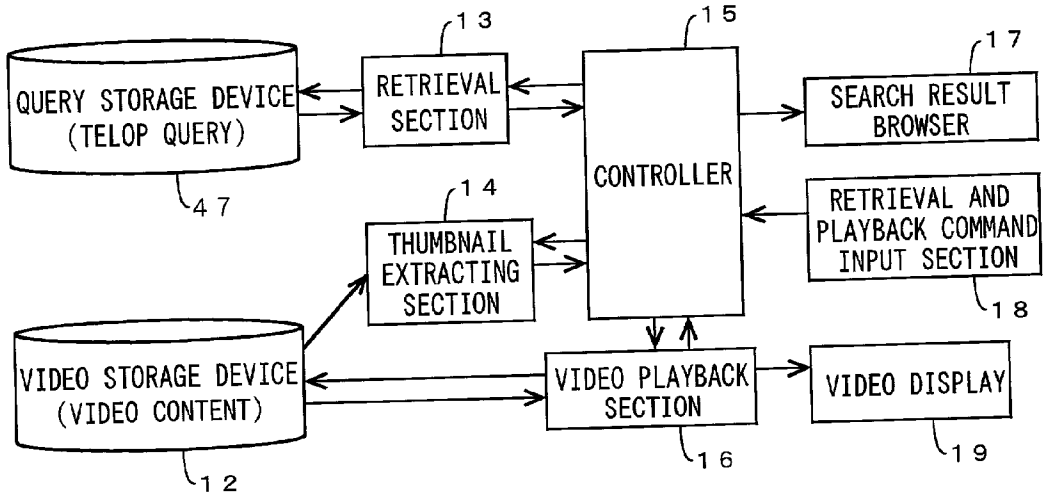


Fig. 1

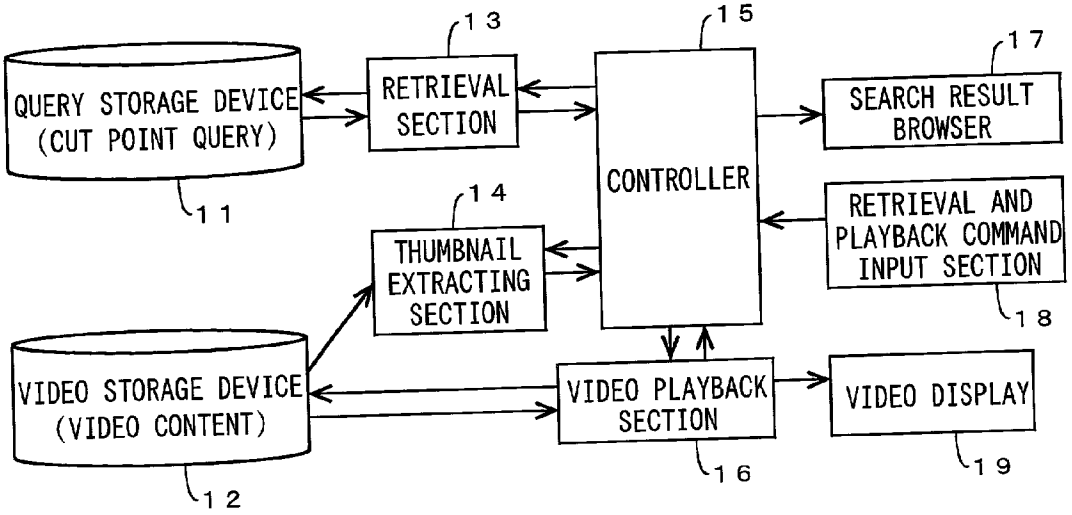

QUERY STORAGE DEVICE (CUT POINT QUERY)
11
RETRIEVAL SECTION
13
CONTROLLER
15
SEARCH RESULT BROWSER
17
RETRIEVAL AND PLAYBACK COMMAND INPUT SECTION
18
THUMBNAIL EXTRACTING SECTION
14
VIDEO STORAGE DEVICE (VIDEO CONTENT)
12
VIDEO PLAYBACK SECTION
16
VIDEO DISPLAY
19

Fig. 2

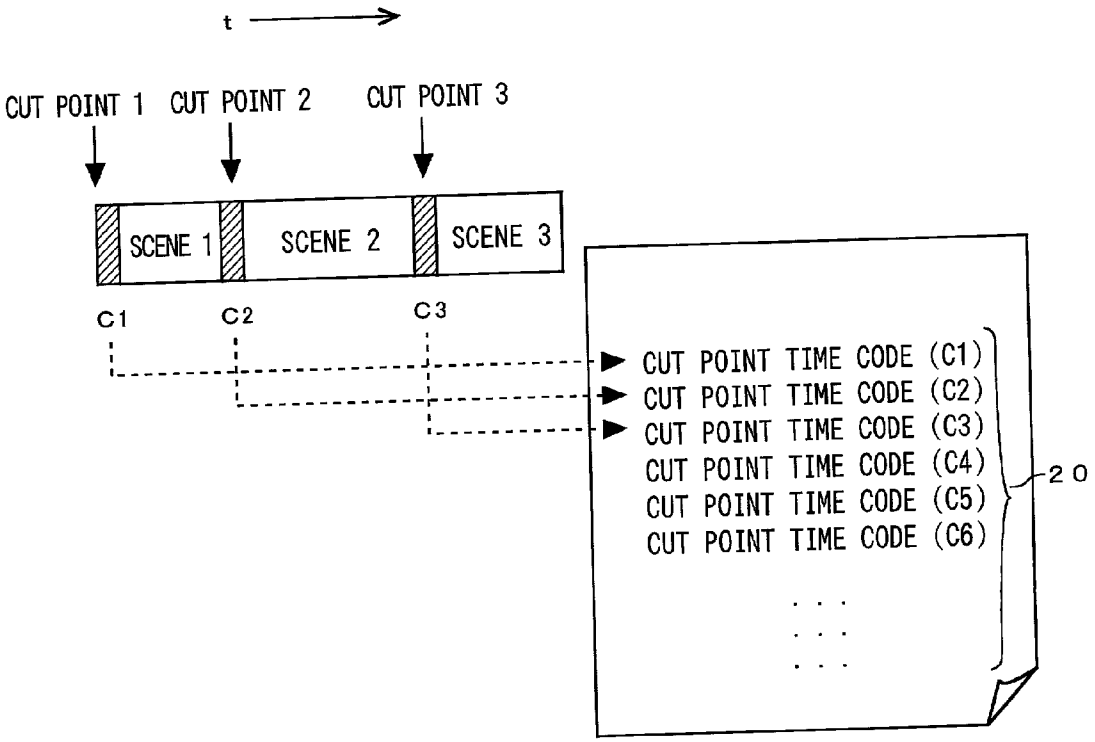

t
CUT POINT 1
CUT POINT 2
CUT POINT 3
SCENE 1
SCENE 2
SCENE 3
C1
C2
C3
CUT POINT TIME CODE (C1)
CUT POINT TIME CODE (C2)
CUT POINT TIME CODE (C3)
CUT POINT TIME CODE (C4)
CUT POINT TIME CODE (C5)
CUT POINT TIME CODE (C6)
20

Fig. 3

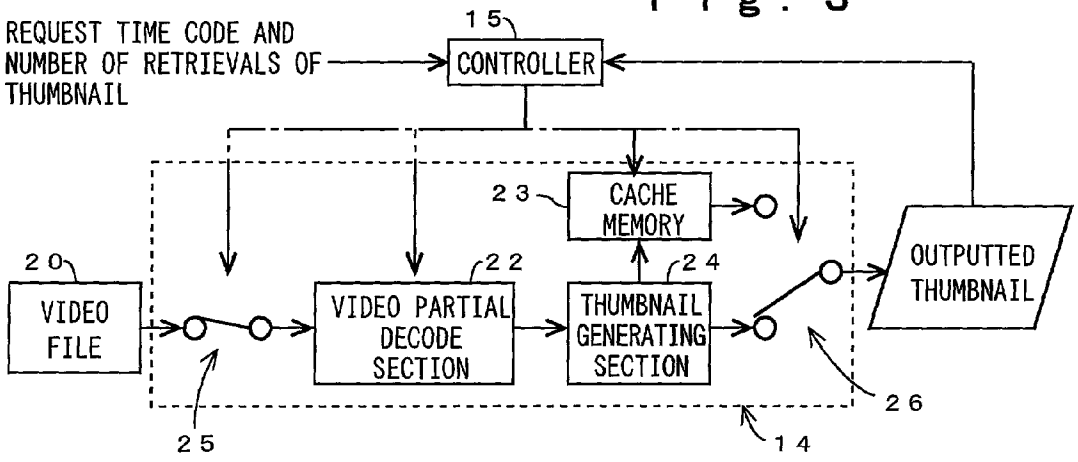


Fig. 4

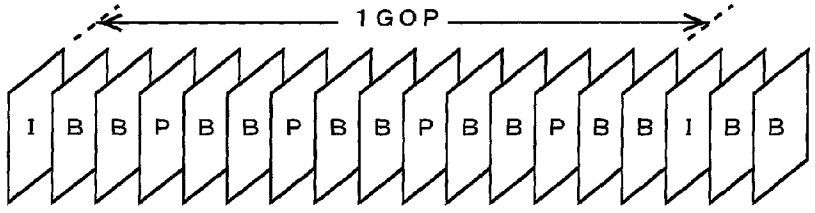


Fig. 6

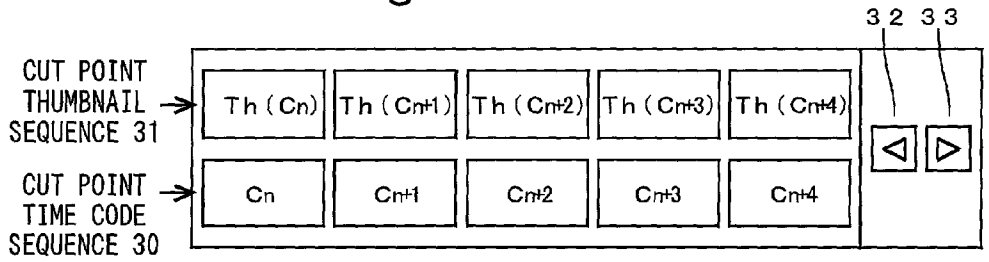


Fig. 7

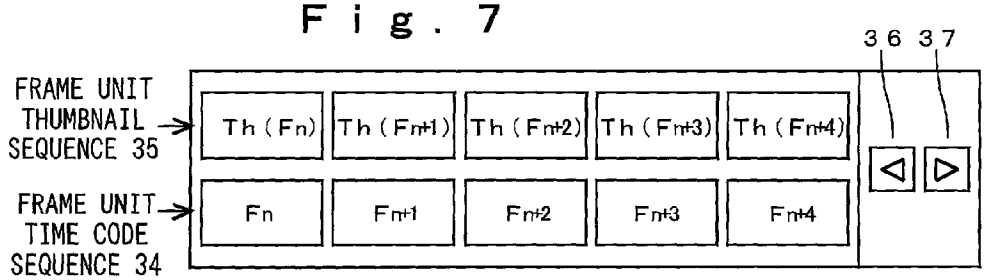


Fig. 5

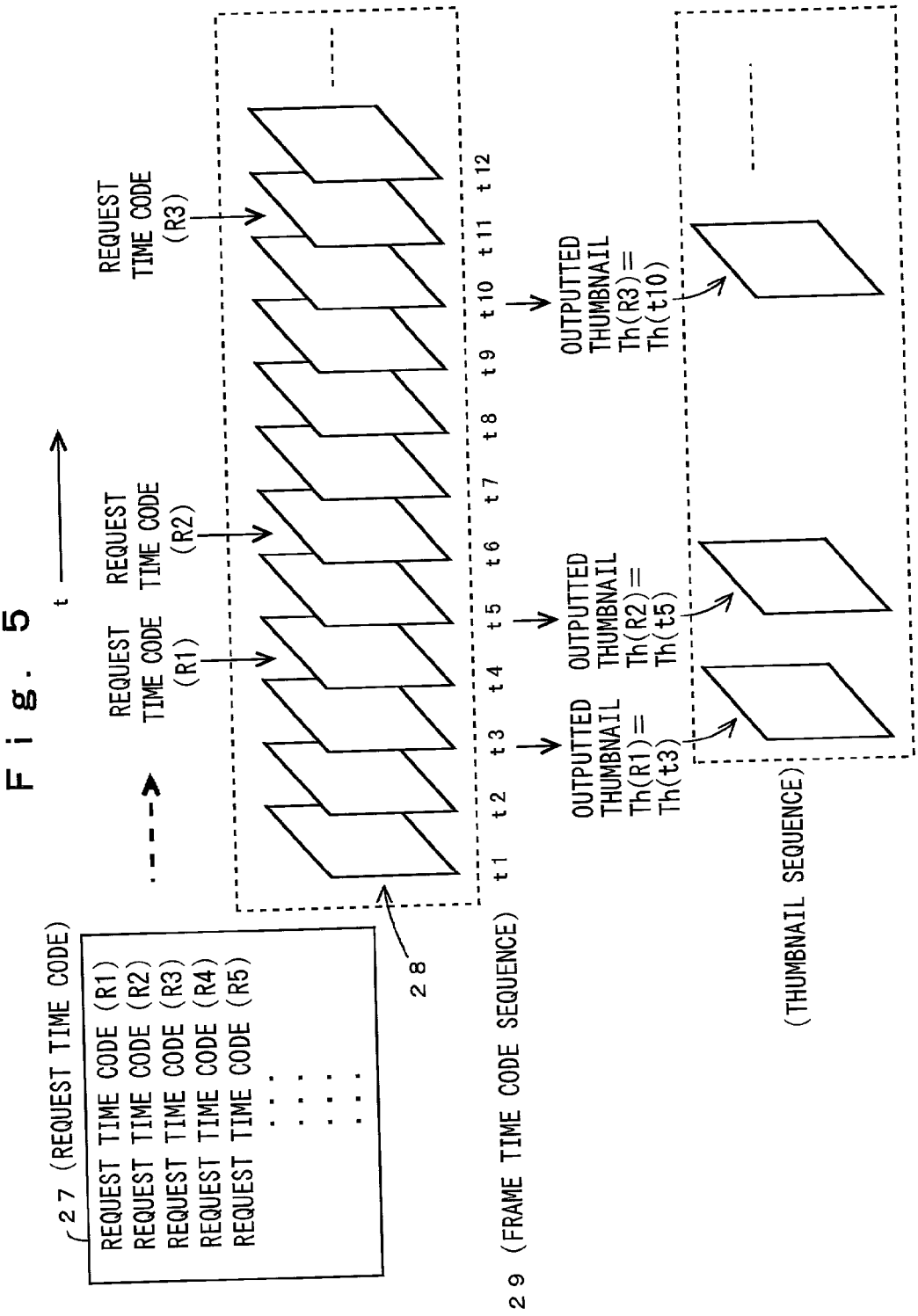

t
REQUEST TIME CODE (R1)
REQUEST TIME CODE (R2)
REQUEST TIME CODE (R3)
27 (REQUEST TIME CODE)
REQUEST TIME CODE (R1)
REQUEST TIME CODE (R2)
REQUEST TIME CODE (R3)
REQUEST TIME CODE (R4)
REQUEST TIME CODE (R5)
28
29 (FRAME TIME CODE SEQUENCE)
t1 t2 t3 t4 t5 t6 t7 t8 t9 t10 t11 t12
OUTPUTTED THUMBNAIL Th(R1)= Th(t3)
OUTPUTTED THUMBNAIL Th(R2)= Th(t5)
OUTPUTTED THUMBNAIL Th(R3)= Th(t10)
(THUMBNAIL SEQUENCE)

Fig. 8

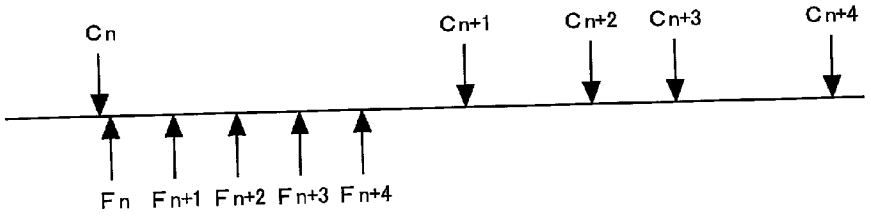


Fig. 10

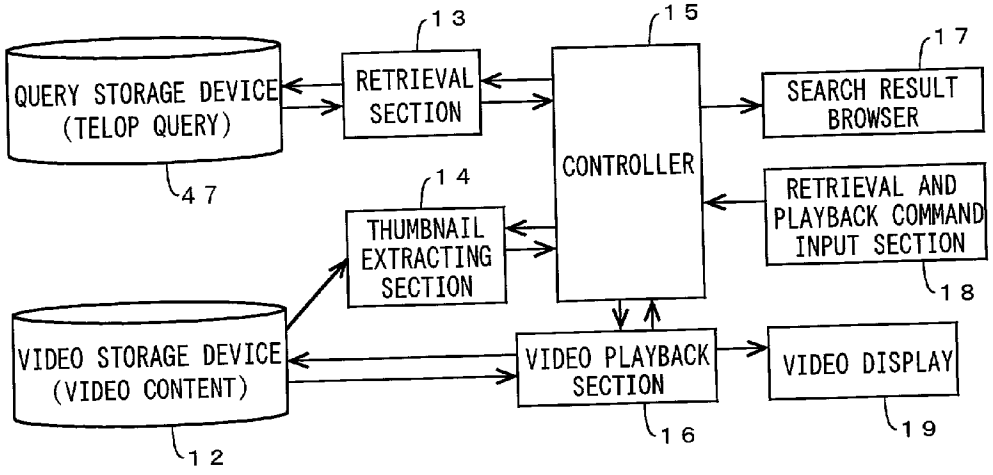


Fig. 11

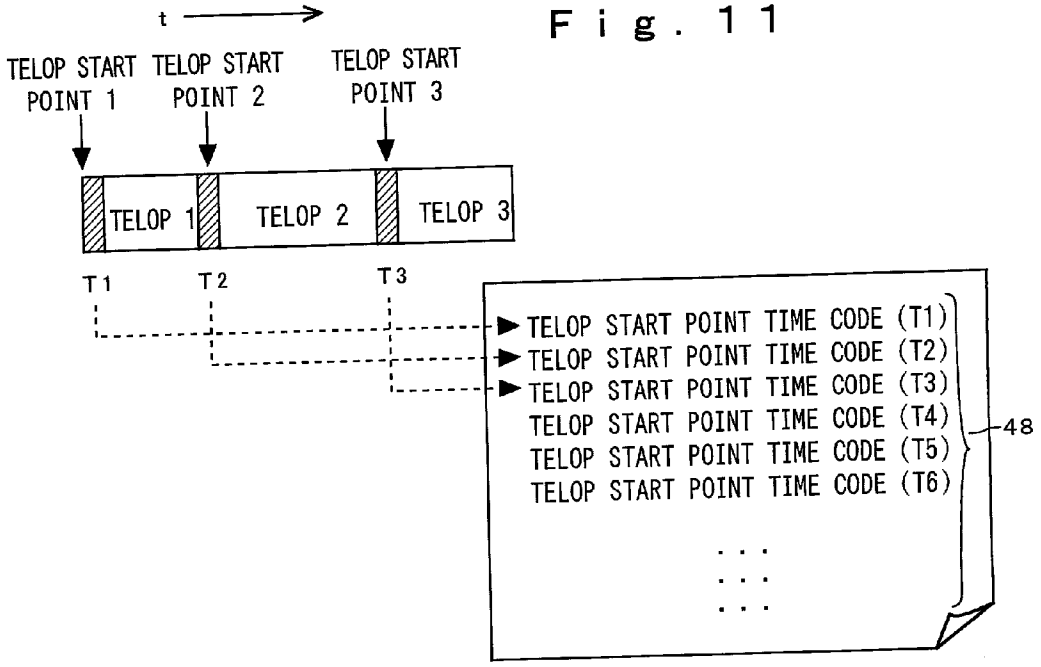


Fig. 9

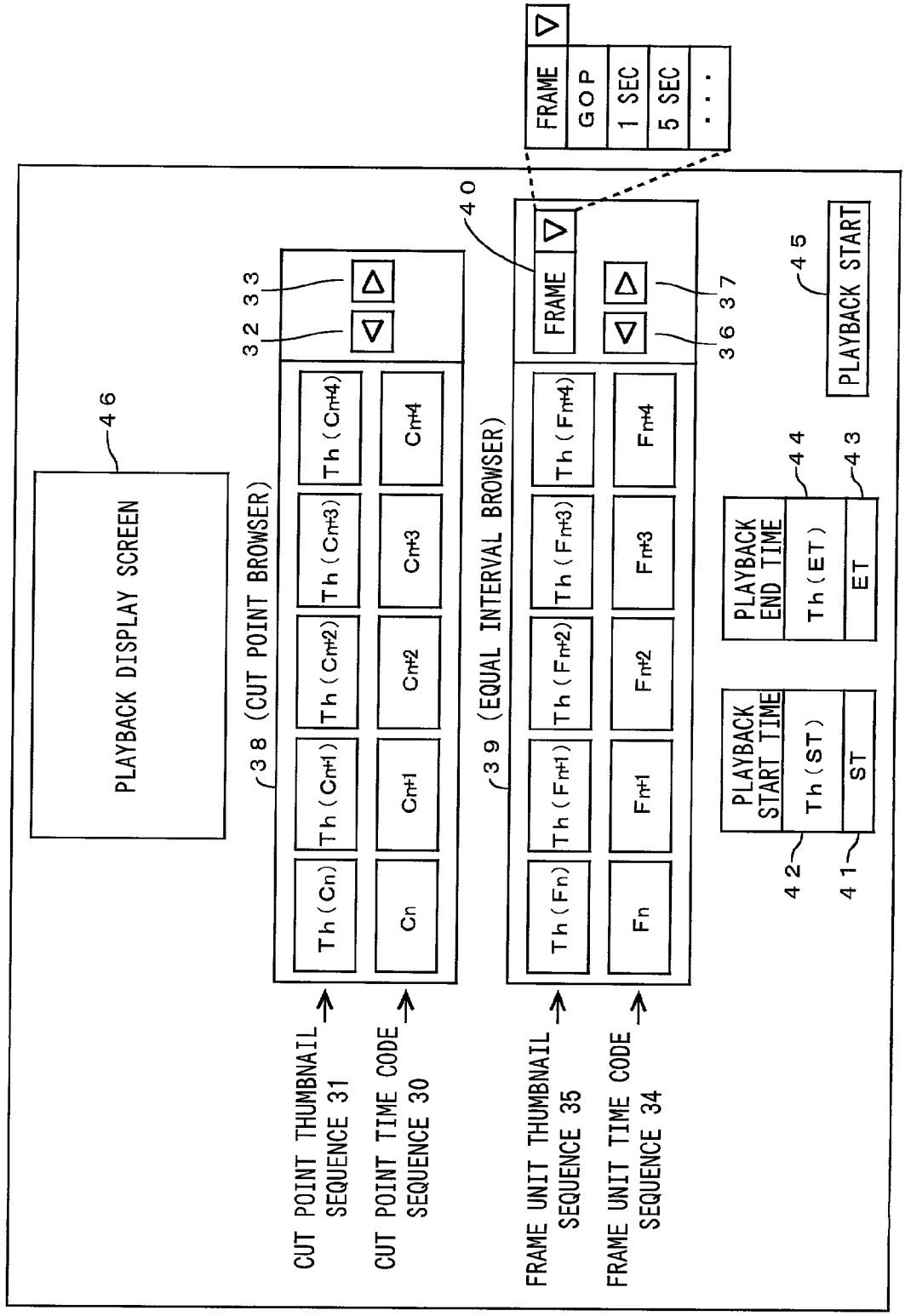

PLAYBACK DISPLAY SCREEN
46
38 (CUT POINT BROWSER)
39 (EQUAL INTERVAL BROWSER)
40
FRAME
GOP
1 SEC
5 SEC
...
32 33
36 37
45
PLAYBACK START
PLAYBACK END TIME
Th(ET)
ET
44
43
PLAYBACK START TIME
Th(ST)
ST
42
41
Th(Cn)
Th(Cn+1)
Th(Cn+2)
Th(Cn+3)
Th(Cn+4)
Cn
Cn+1
Cn+2
Cn+3
Cn+4
Th(Fn)
Th(Fn+1)
Th(Fn+2)
Th(Fn+3)
Th(Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
CUT POINT THUMBNAIL SEQUENCE 31
CUT POINT TIME CODE SEQUENCE 30
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34

Fig. 12

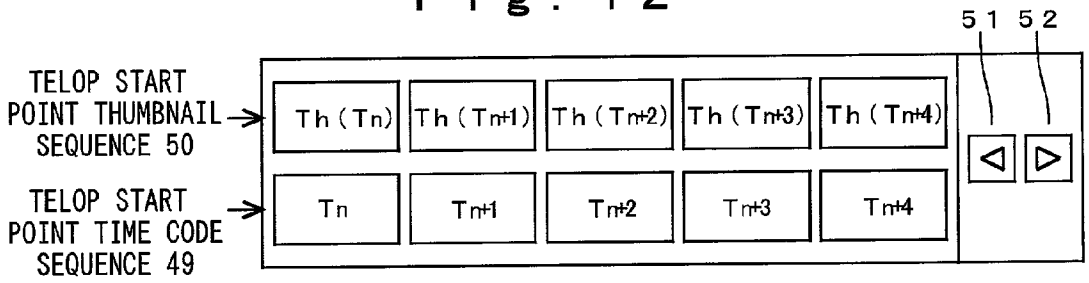


Fig. 13

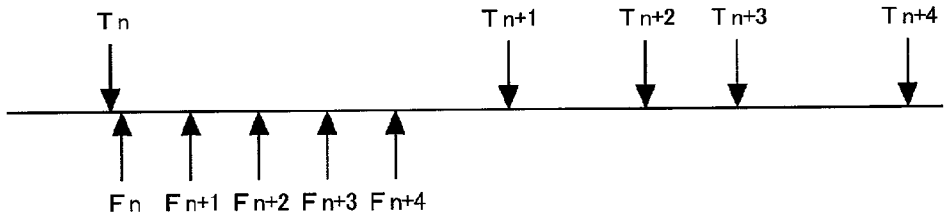


Fig. 15

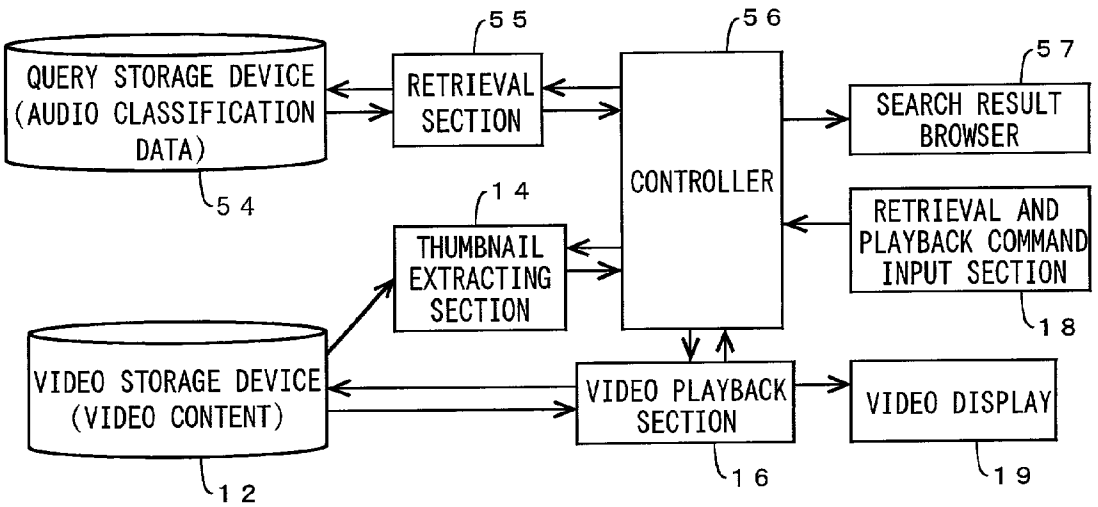
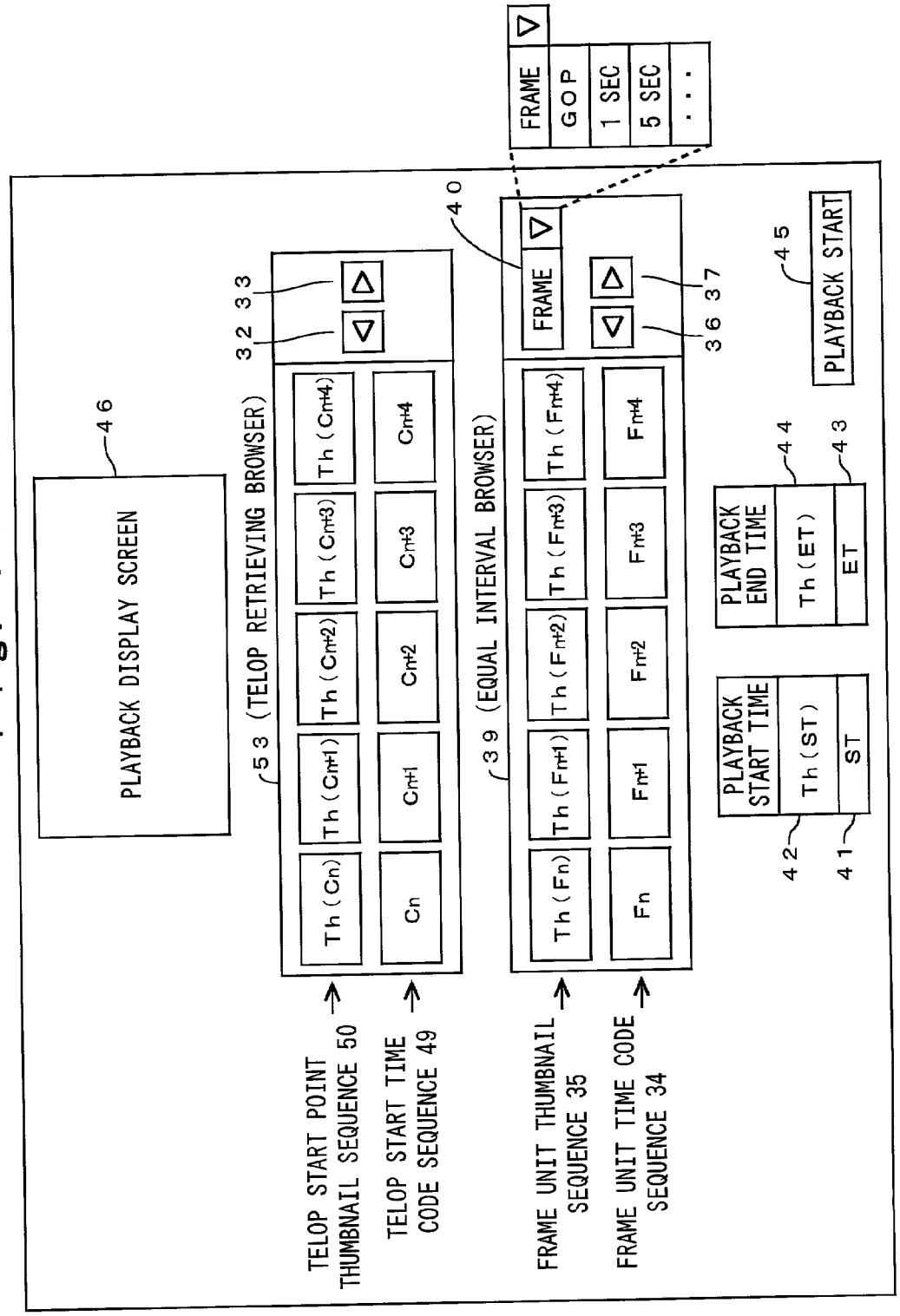


Fig. 14


PLAYBACK DISPLAY SCREEN
46
(TELOP RETRIEVING BROWSER)
53
32 33
Th(Cn)
Th(Cn+1)
Th(Cn+2)
Th(Cn+3)
Th(Cn+4)
Cn
Cn+1
Cn+2
Cn+3
Cn+4
TELOP START POINT THUMBNAIL SEQUENCE 50
TELOP START TIME CODE SEQUENCE 49
(EQUAL INTERVAL BROWSER)
39
40
FRAME
GOP
1 SEC
5 SEC
. . .
36 37
Th(Fn)
Th(Fn+1)
Th(Fn+2)
Th(Fn+3)
Th(Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34
PLAYBACK START
45
PLAYBACK END TIME
44
Th(ET)
ET
43
PLAYBACK START TIME
Th(ST)
ST
42
41

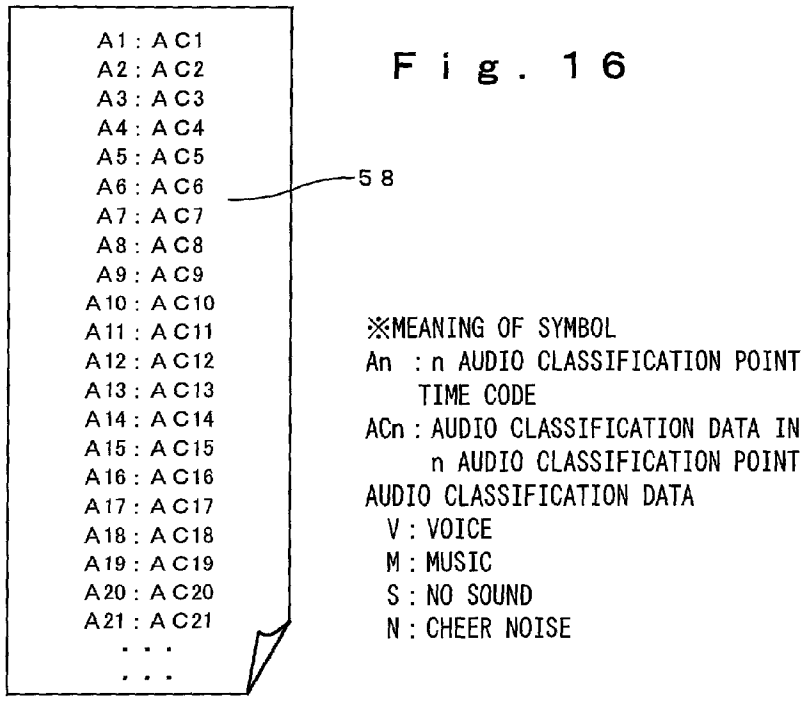


Fig. 16

Fig. 17

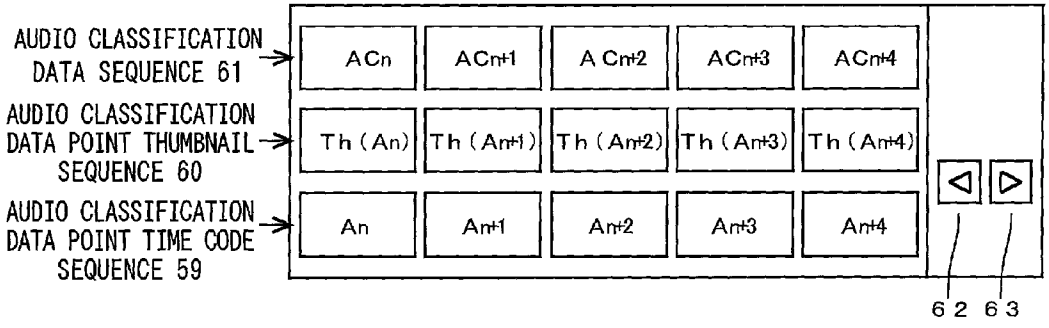


Fig. 18

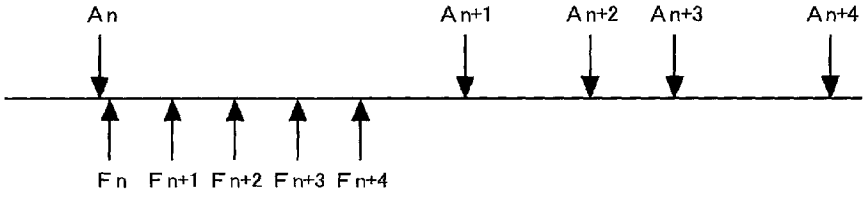


Fig. 19

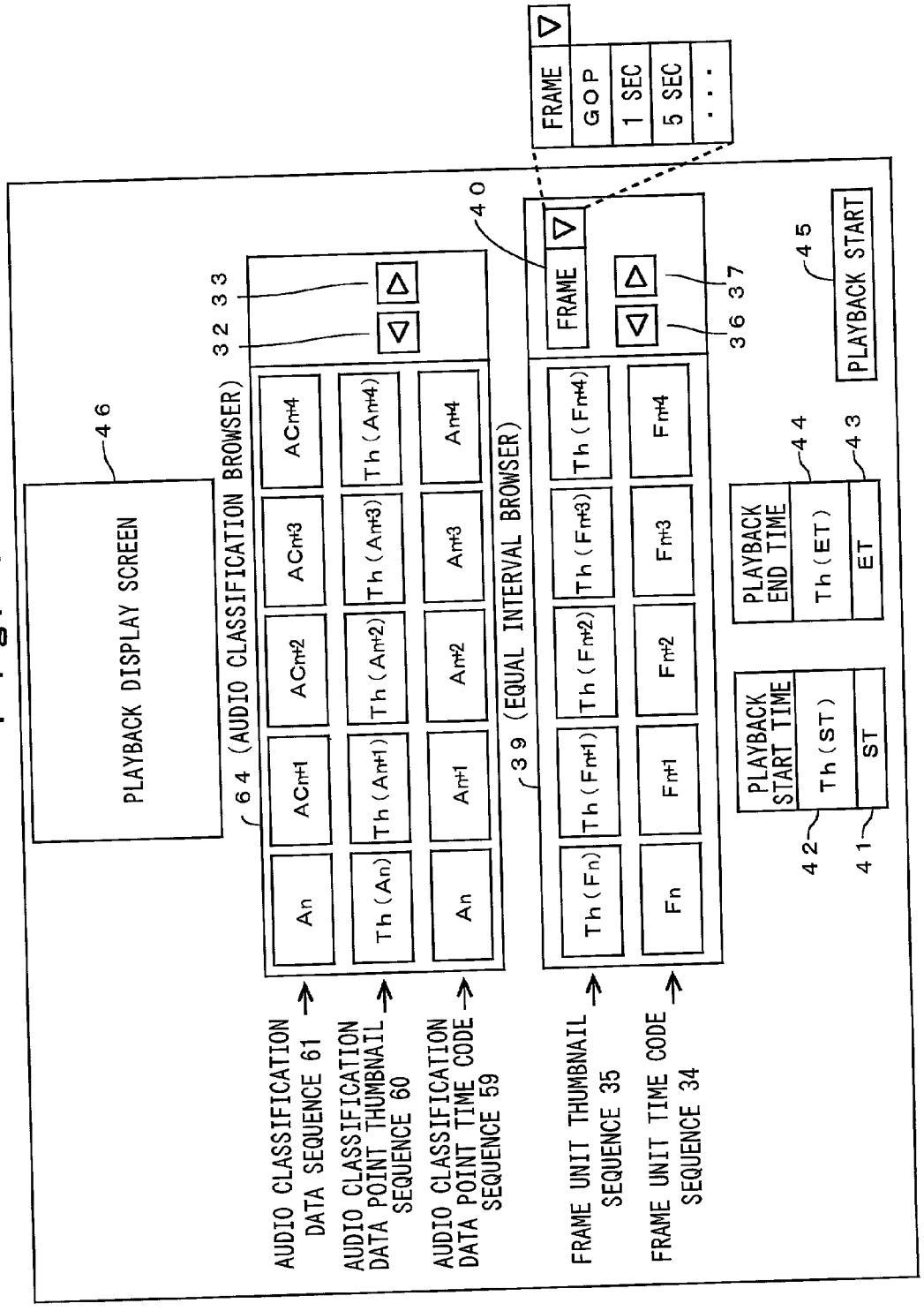

PLAYBACK DISPLAY SCREEN
46
64 (AUDIO CLASSIFICATION BROWSER)
32 33
An
ACn+1
ACn+2
ACn+3
ACn+4
Th(An)
Th(An+1)
Th(An+2)
Th(An+3)
Th(An+4)
An
An+1
An+2
An+3
An+4
AUDIO CLASSIFICATION DATA SEQUENCE 61
AUDIO CLASSIFICATION DATA POINT THUMBNAIL SEQUENCE 60
AUDIO CLASSIFICATION DATA POINT TIME CODE SEQUENCE 59
39 (EQUAL INTERVAL BROWSER)
40
FRAME
36 37
Th(Fn)
Th(Fn+1)
Th(Fn+2)
Th(Fn+3)
Th(Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34
FRAME
GOP
1 SEC
5 SEC
. . .
PLAYBACK START TIME
Th(ST)
ST
42
41
PLAYBACK END TIME
Th(ET)
ET
44
43
45
PLAYBACK START

Fig. 20

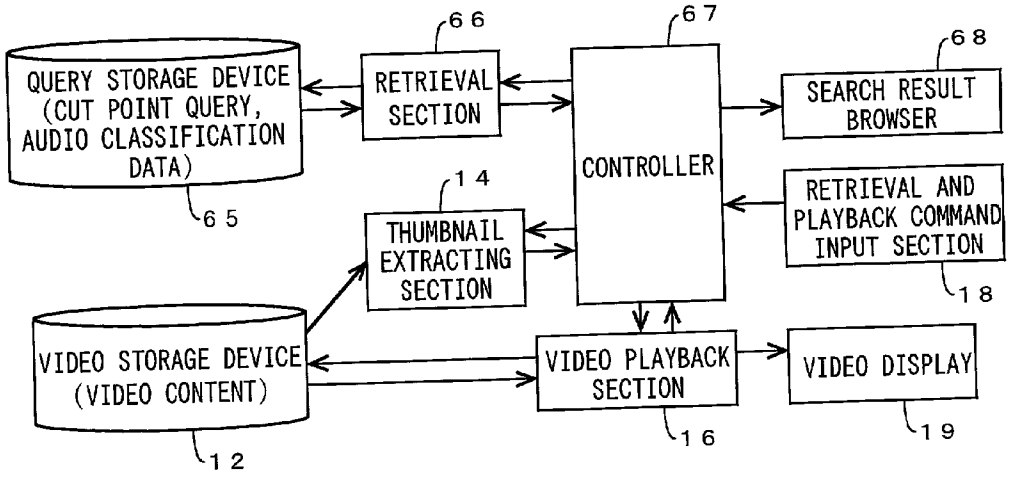


Fig. 21

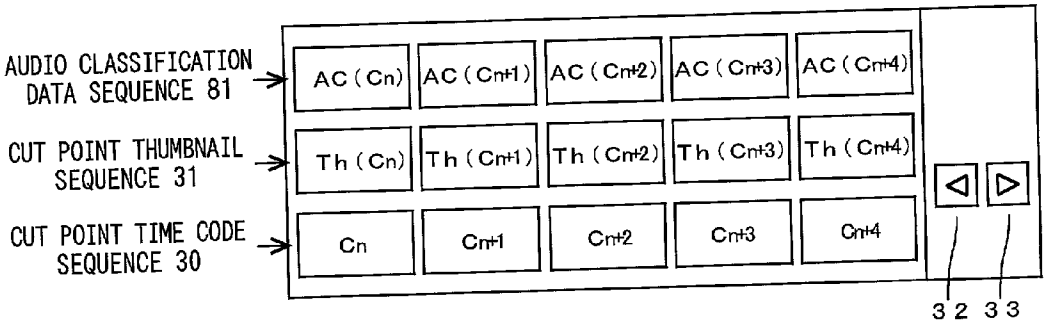


Fig. 23

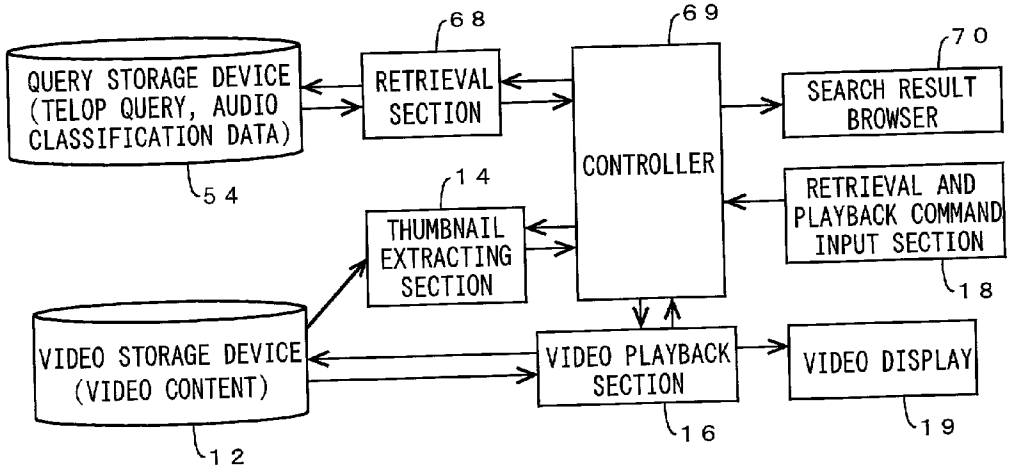


Fig. 22

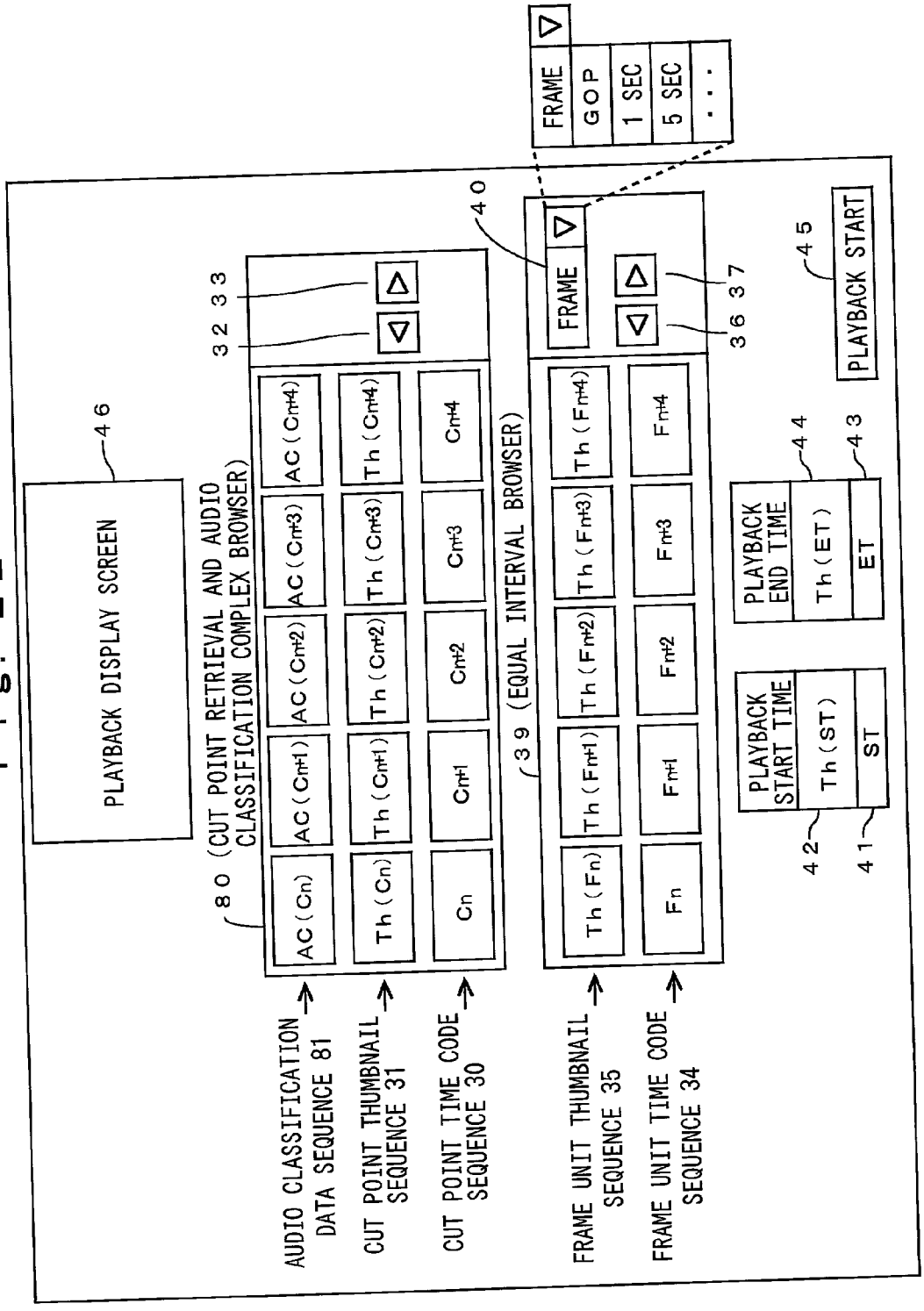

PLAYBACK DISPLAY SCREEN
46
80 (CUT POINT RETRIEVAL AND AUDIO CLASSIFICATION COMPLEX BROWSER)
32 33
AC (Cn)
AC (Cn+1)
AC (Cn+2)
AC (Cn+3)
AC (Cn+4)
Th (Cn)
Th (Cn+1)
Th (Cn+2)
Th (Cn+3)
Th (Cn+4)
Cn
Cn+1
Cn+2
Cn+3
Cn+4
AUDIO CLASSIFICATION DATA SEQUENCE 81
CUT POINT THUMBNAIL SEQUENCE 31
CUT POINT TIME CODE SEQUENCE 30
40
FRAME
GOP
1 SEC
5 SEC
. . .
39 (EQUAL INTERVAL BROWSER)
36 37
Th (Fn)
Th (Fn+1)
Th (Fn+2)
Th (Fn+3)
Th (Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34
45
PLAYBACK START
44
PLAYBACK END TIME
Th (ET)
43
ET
PLAYBACK START TIME
Th (ST)
ST
42
41

Fig. 24

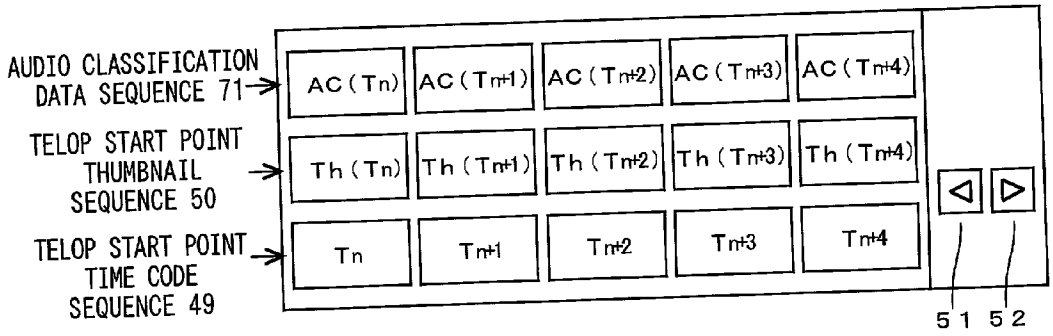

AUDIO CLASSIFICATION DATA SEQUENCE 71
TELOP START POINT THUMBNAIL SEQUENCE 50
TELOP START POINT TIME CODE SEQUENCE 49
AC(Tn)
AC(Tn+1)
AC(Tn+2)
AC(Tn+3)
AC(Tn+4)
Th(Tn)
Th(Tn+1)
Th(Tn+2)
Th(Tn+3)
Th(Tn+4)
Tn
Tn+1
Tn+2
Tn+3
Tn+4
51
52

Fig. 26

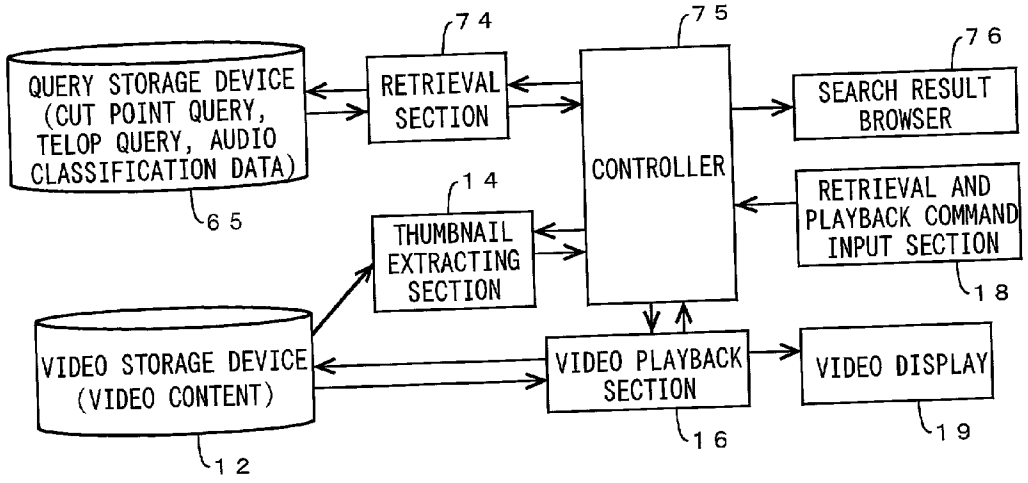

QUERY STORAGE DEVICE (CUT POINT QUERY, TELOP QUERY, AUDIO CLASSIFICATION DATA)
65
RETRIEVAL SECTION
74
CONTROLLER
75
SEARCH RESULT BROWSER
76
RETRIEVAL AND PLAYBACK COMMAND INPUT SECTION
18
THUMBNAIL EXTRACTING SECTION
14
VIDEO STORAGE DEVICE (VIDEO CONTENT)
12
VIDEO PLAYBACK SECTION
16
VIDEO DISPLAY
19

Fig. 25

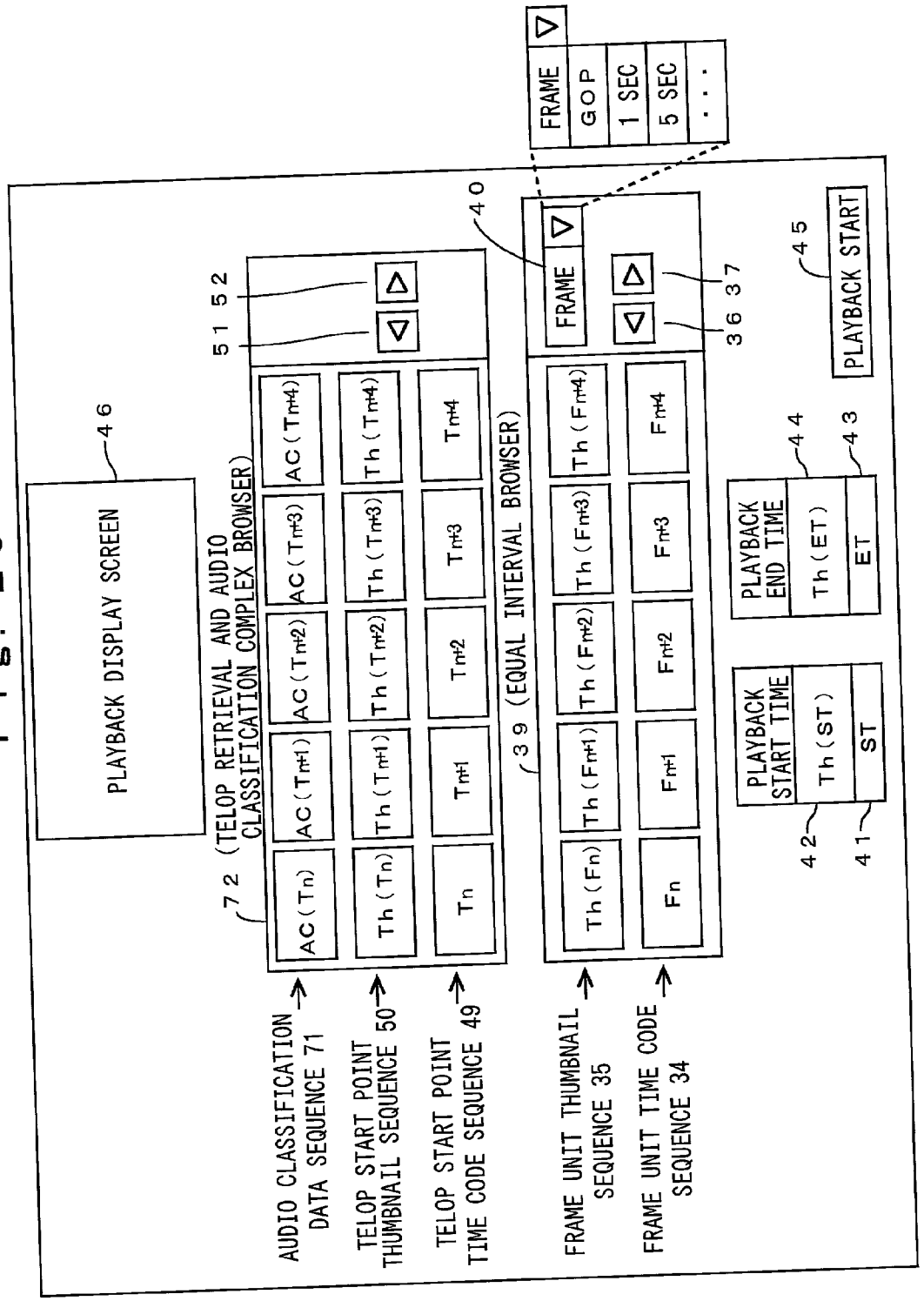

PLAYBACK DISPLAY SCREEN
46
72 (TELOP RETRIEVAL AND AUDIO CLASSIFICATION COMPLEX BROWSER)
AC(Tn)
AC(Tn+1)
AC(Tn+2)
AC(Tn+3)
AC(Tn+4)
Th(Tn)
Th(Tn+1)
Th(Tn+2)
Th(Tn+3)
Th(Tn+4)
Tn
Tn+1
Tn+2
Tn+3
Tn+4
51
52
39 (EQUAL INTERVAL BROWSER)
40
FRAME
36
37
Th(Fn)
Th(Fn+1)
Th(Fn+2)
Th(Fn+3)
Th(Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
AUDIO CLASSIFICATION DATA SEQUENCE 71
TELOP START POINT THUMBNAIL SEQUENCE 50
TELOP START POINT TIME CODE SEQUENCE 49
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34
PLAYBACK START TIME
Th(ST)
ST
42
41
PLAYBACK END TIME
Th(ET)
ET
44
43
45
PLAYBACK START
FRAME
GOP
1 SEC
5 SEC
. . .

Fig. 27

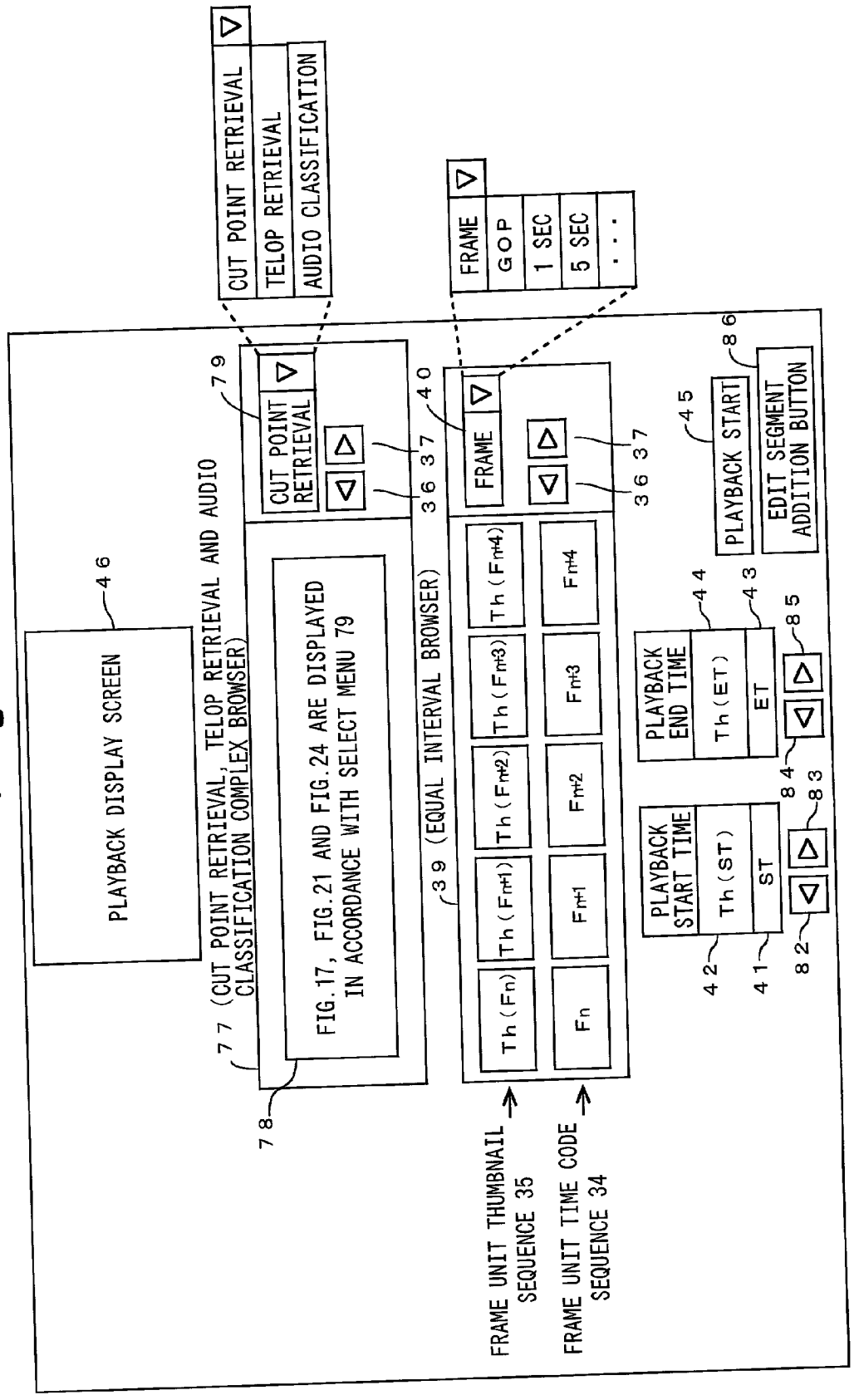

PLAYBACK DISPLAY SCREEN
46
(CUT POINT RETRIEVAL, TELOP RETRIEVAL AND AUDIO CLASSIFICATION COMPLEX BROWSER)
77
FIG. 17, FIG. 21 AND FIG. 24 ARE DISPLAYED IN ACCORDANCE WITH SELECT MENU 79
78
79
CUT POINT RETRIEVAL
TELOP RETRIEVAL
AUDIO CLASSIFICATION
CUT POINT RETRIEVAL
36 37
40
FRAME
GOP
1 SEC
5 SEC
. . .
FRAME
36 37
39 (EQUAL INTERVAL BROWSER)
Th(Fn)
Th(Fn+1)
Th(Fn+2)
Th(Fn+3)
Th(Fn+4)
Fn
Fn+1
Fn+2
Fn+3
Fn+4
FRAME UNIT THUMBNAIL SEQUENCE 35
FRAME UNIT TIME CODE SEQUENCE 34
PLAYBACK START TIME
Th(ST)
ST
42
41
82
83
84
PLAYBACK END TIME
Th(ET)
ET
44
43
85
45
PLAYBACK START
86
EDIT SEGMENT ADDITION BUTTON

Fig. 28

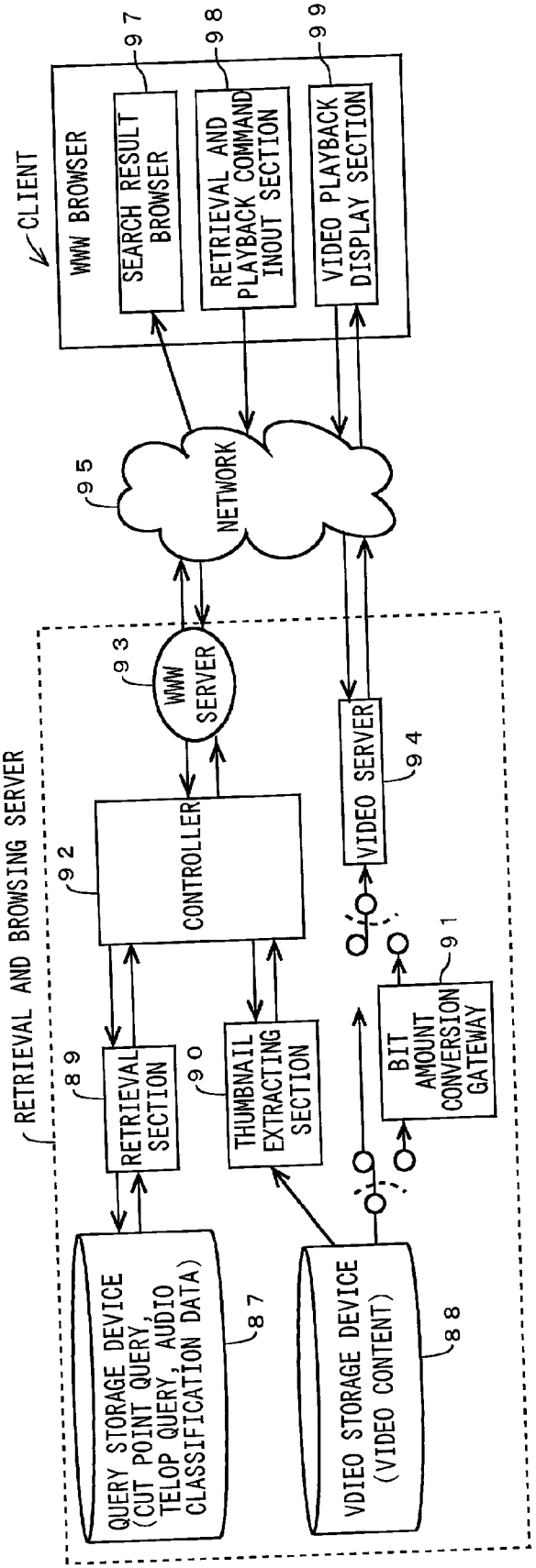

CLIENT
WWW BROWSER
SEARCH RESULT BROWSER
RETRIEVAL AND PLAYBACK COMMAND INOUT SECTION
VIDEO PLAYBACK DISPLAY SECTION
97
98
99
NETWORK
95
RETRIEVAL AND BROWSING SERVER
WWW SERVER
93
CONTROLLER
92
VIDEO SERVER
94
RETRIEVAL SECTION
89
THUMBNAIL EXTRACTING SECTION
90
BIT AMOUNT CONVERSION GATEWAY
91
QUERY STORAGE DEVICE (CUT POINT QUERY, TELOP QUERY, AUDIO CLASSIFICATION DATA)
87
VDIEO STORAGE DEVICE (VIDEO CONTENT)
88

Fig. 29

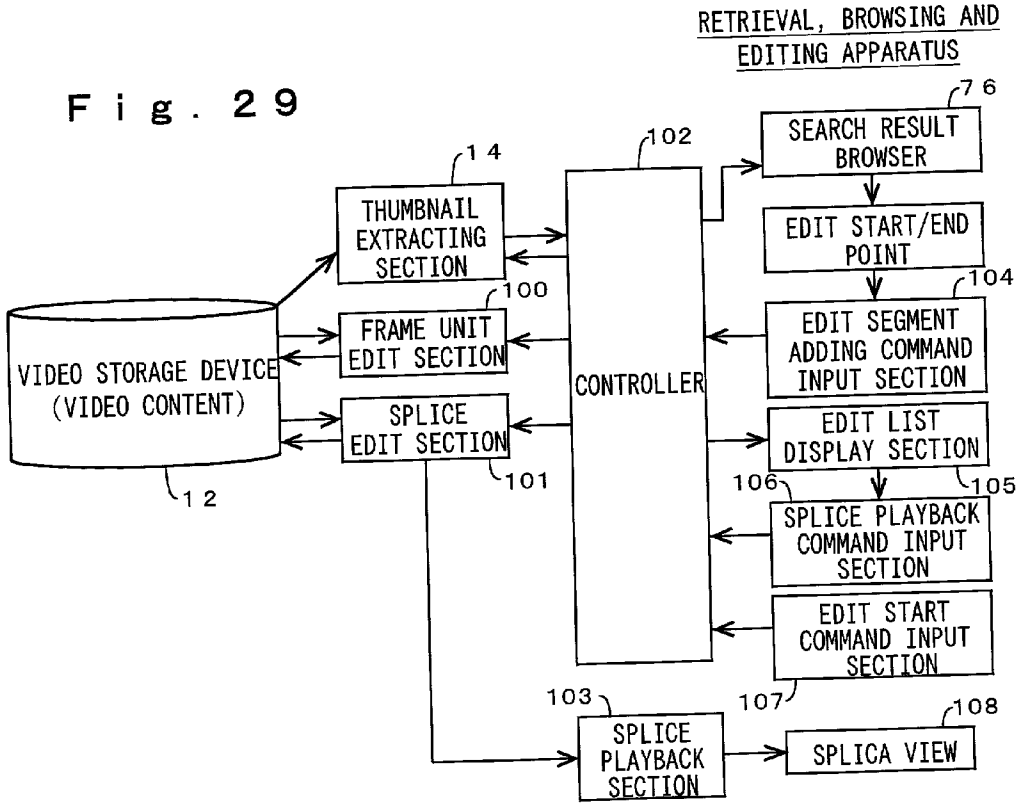

RETRIEVAL, BROWSING AND EDITING APPARATUS
76
SEARCH RESULT BROWSER
EDIT START/END POINT
104
EDIT SEGMENT ADDING COMMAND INPUT SECTION
EDIT LIST DISPLAY SECTION
106
105
SPLICE PLAYBACK COMMAND INPUT SECTION
EDIT START COMMAND INPUT SECTION
107
108
SPLICA VIEW
102
CONTROLLER
14
THUMBNAIL EXTRACTING SECTION
100
FRAME UNIT EDIT SECTION
SPLICE EDIT SECTION
101
VIDEO STORAGE DEVICE (VIDEO CONTENT)
12
103
SPLICE PLAYBACK SECTION

Fig. 30

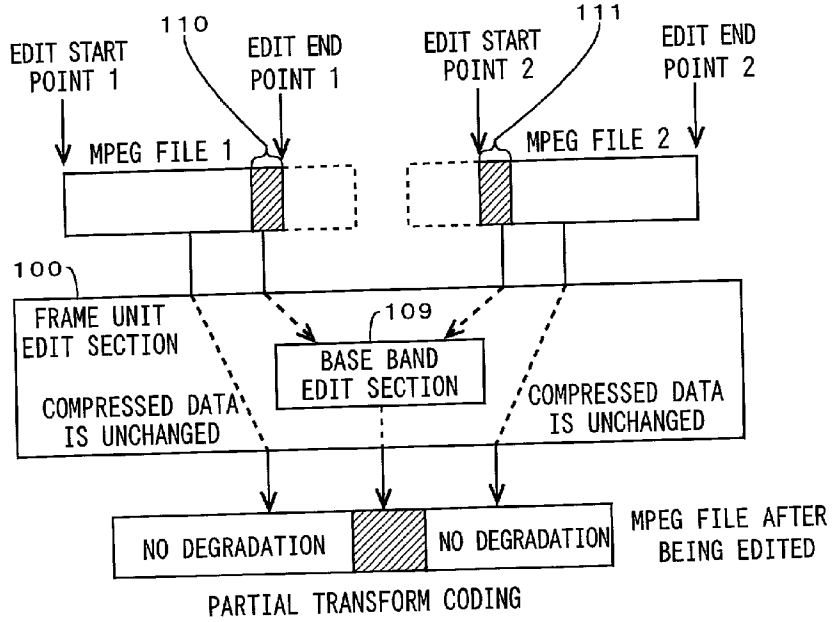

EDIT START POINT 1
110
EDIT END POINT 1
EDIT START POINT 2
111
EDIT END POINT 2
MPEG FILE 1
MPEG FILE 2
100
FRAME UNIT EDIT SECTION
109
BASE BAND EDIT SECTION
COMPRESSED DATA IS UNCHANGED
COMPRESSED DATA IS UNCHANGED
NO DEGRADATION
NO DEGRADATION
MPEG FILE AFTER BEING EDITED
PARTIAL TRANSFORM CODING

Fig. 31

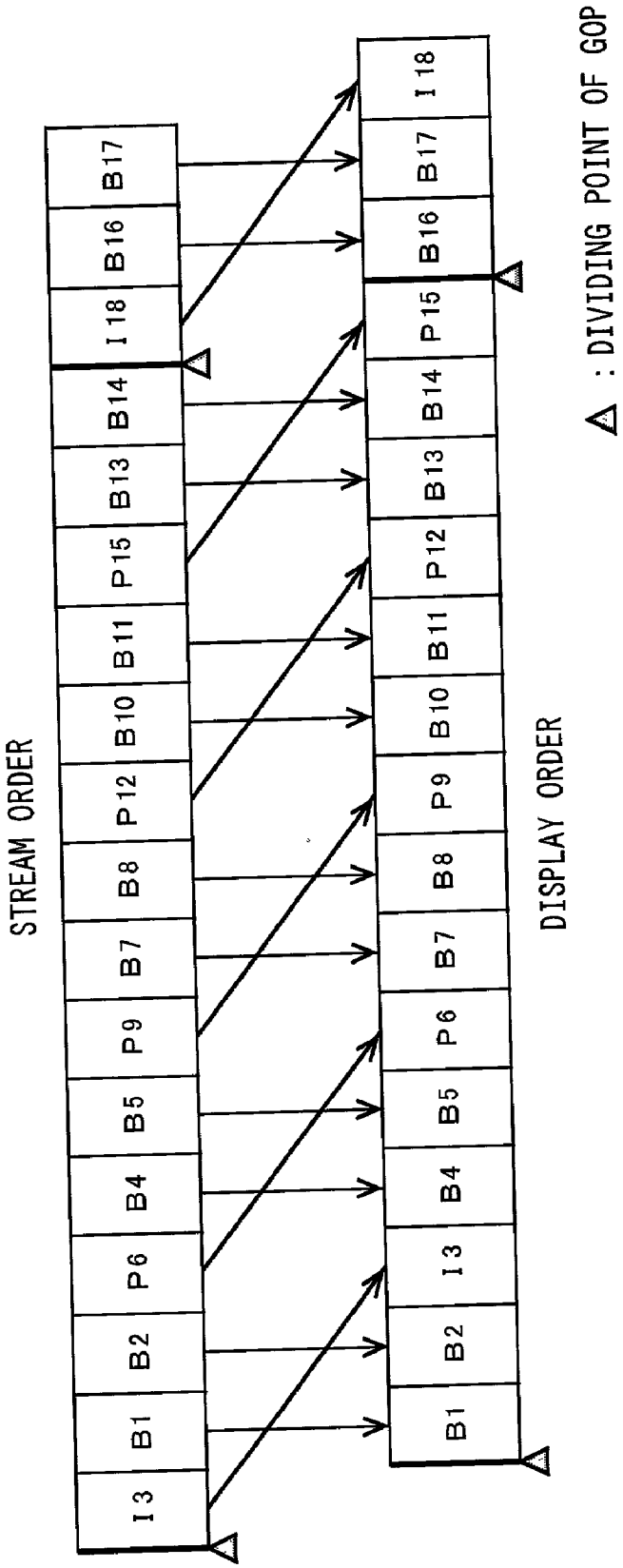

STREAM ORDER
I3
B1
B2
P6
B4
B5
P9
B7
B8
P12
B10
B11
P15
B13
B14
I18
B16
B17
DISPLAY ORDER
B1
B2
I3
B4
B5
P6
B7
B8
P9
B10
B11
P12
B13
B14
P15
B16
B17
I18
△ : DIVIDING POINT OF GOP

Fig. 32

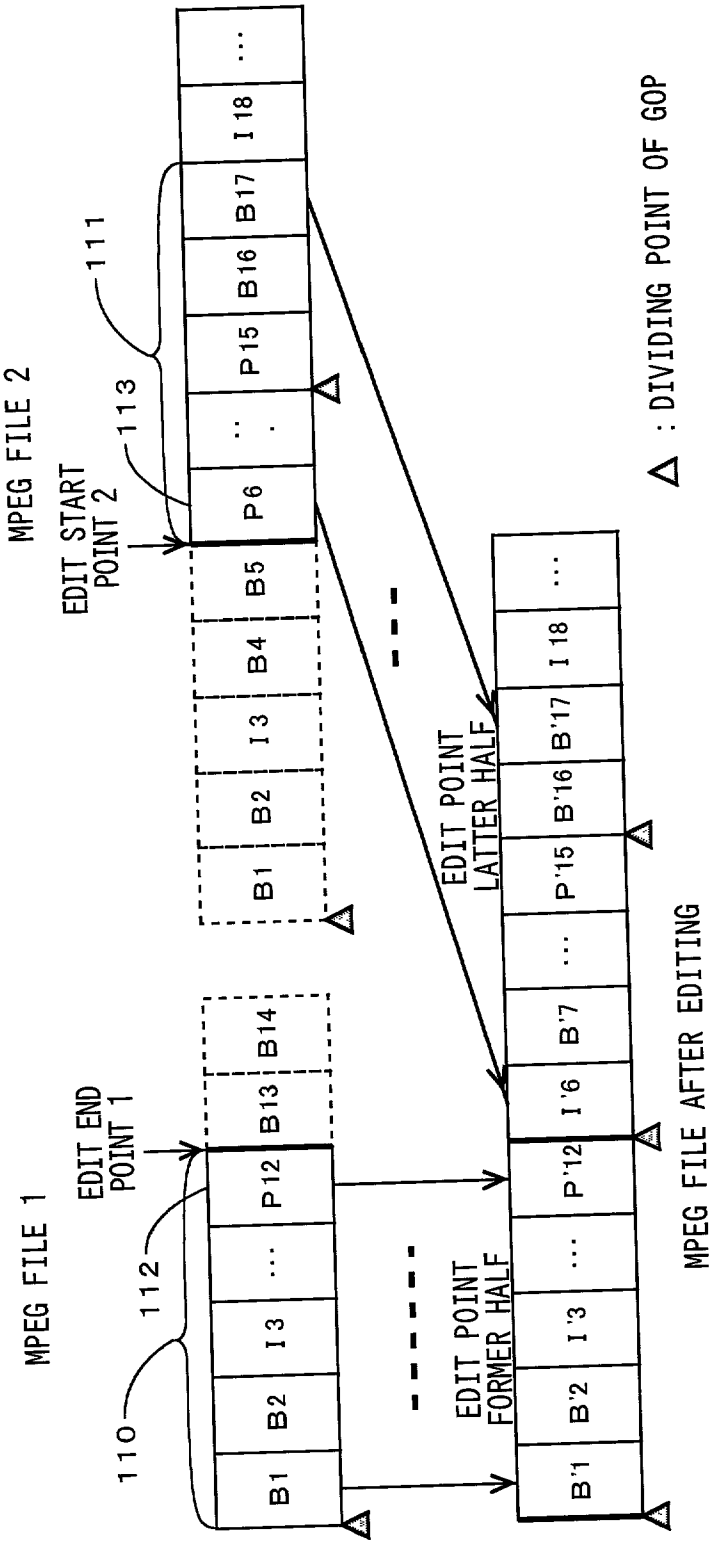
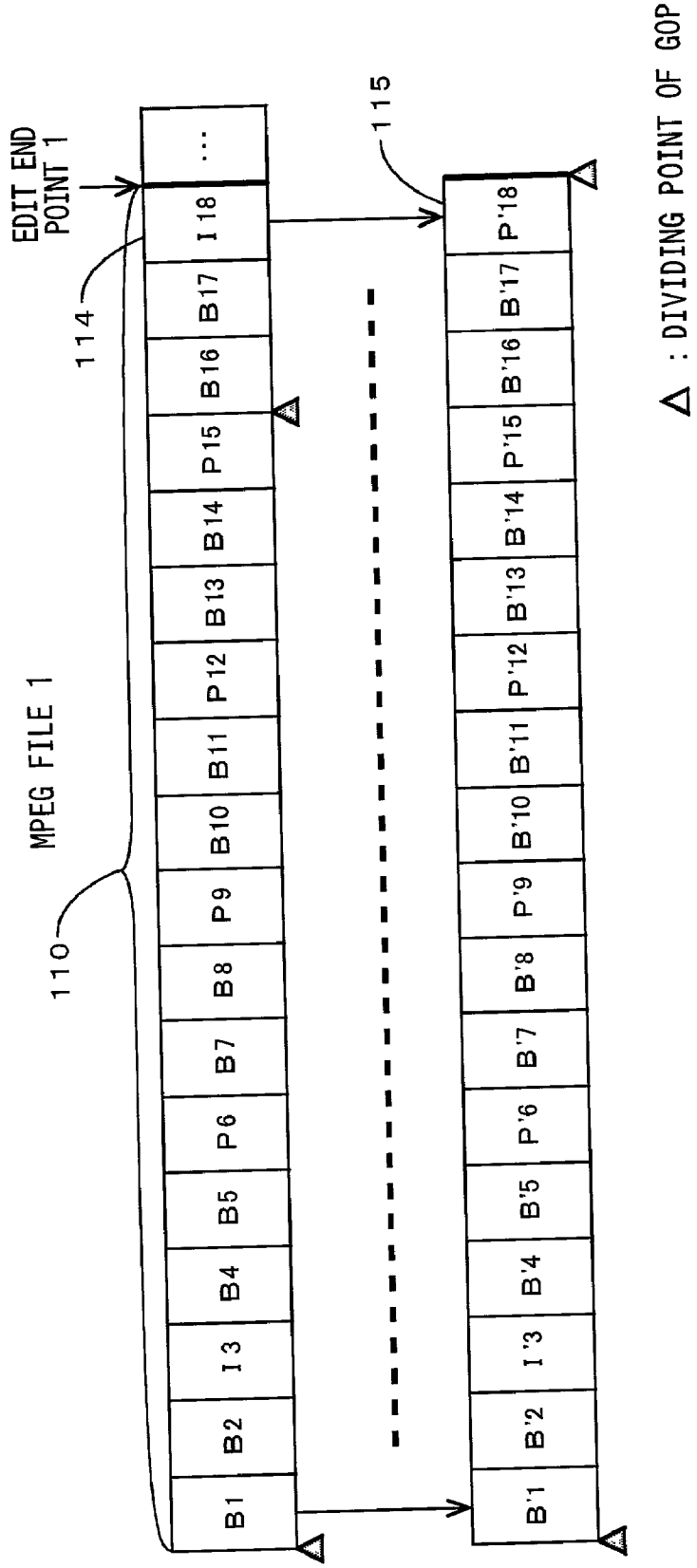

MPEG FILE 1
MPEG FILE 2
MPEG FILE AFTER EDITING
EDIT START POINT 2
EDIT END POINT 1
EDIT POINT FORMER HALF
EDIT POINT LATTER HALF
△ : DIVIDING POINT OF GOP
110
111
112
113
B1
B2
I3
...
P12
B13
B14
P6
...
P15
B16
B17
I18
B4
B5
B'1
B'2
I'3
...
P'12
I'6
B'7
...
P'15
B'16
B'17
I'18

Fig. 33


MPEG FILE 1
110
EDIT END POINT 1
114
115
B1
B2
I3
B4
B5
P6
B7
B8
P9
B10
B11
P12
B13
B14
P15
B16
B17
I18
...
B'1
B'2
I'3
B'4
B'5
P'6
B'7
B'8
P'9
B'10
B'11
P'12
B'13
B'14
P'15
B'16
B'17
P'18
△ : DIVIDING POINT OF GOP

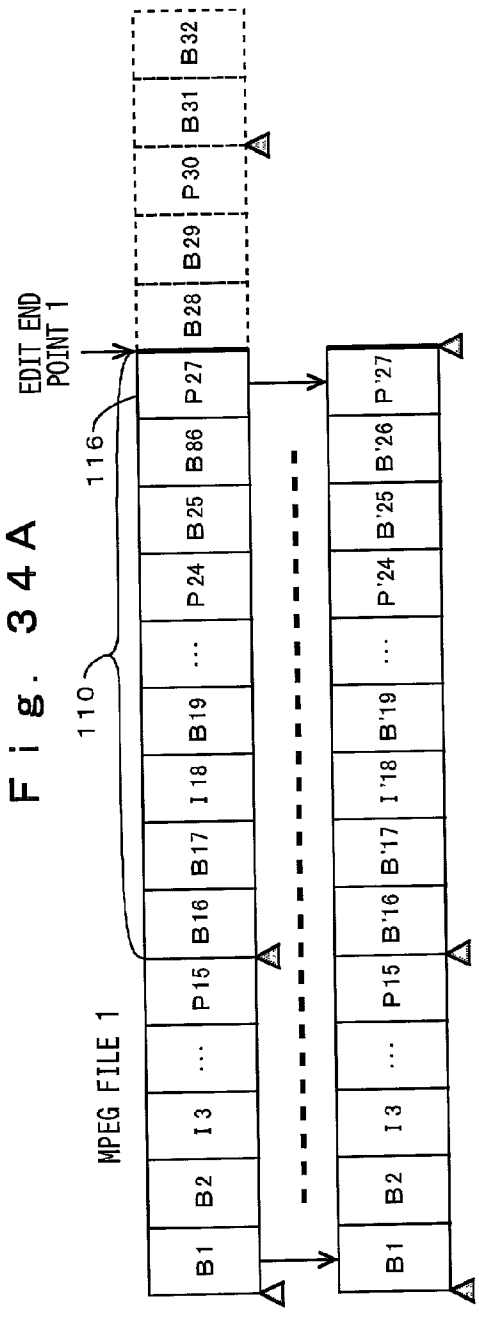


Fig. 34A

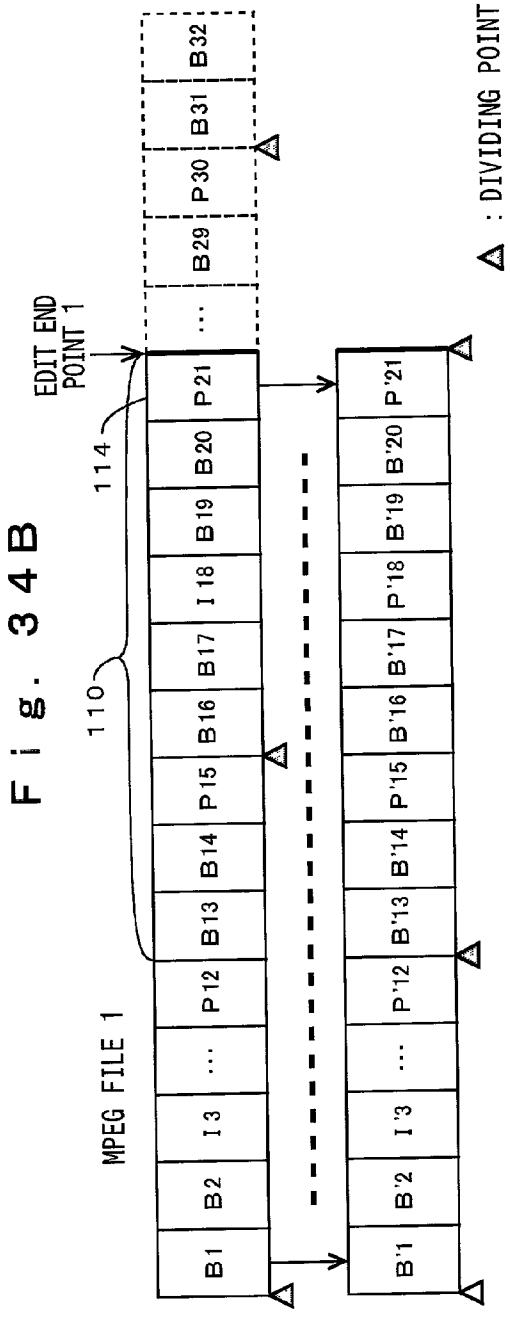


Fig. 34B

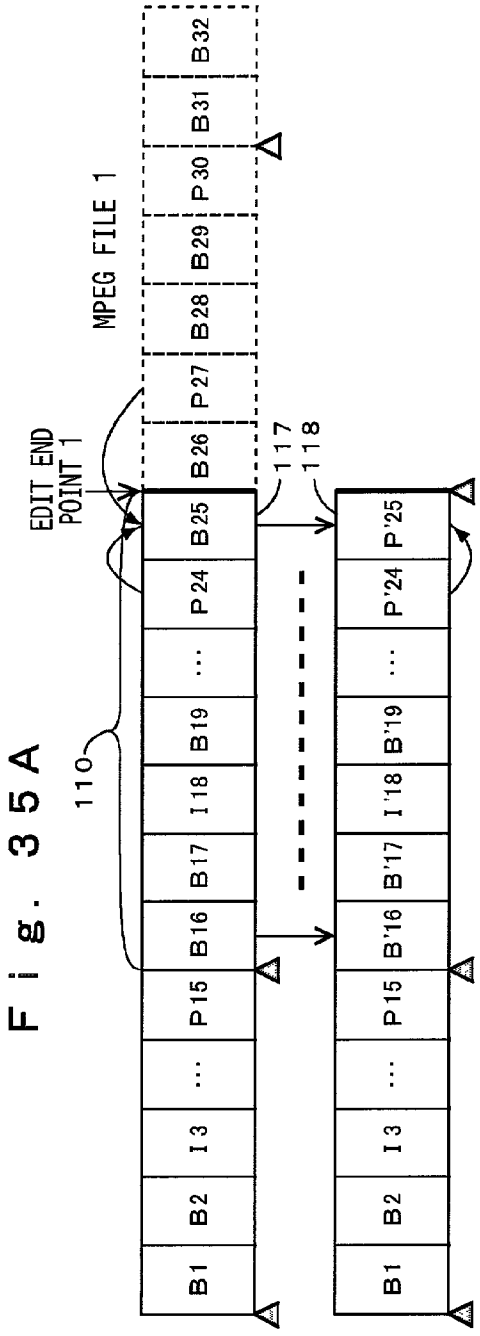


Fig. 35A

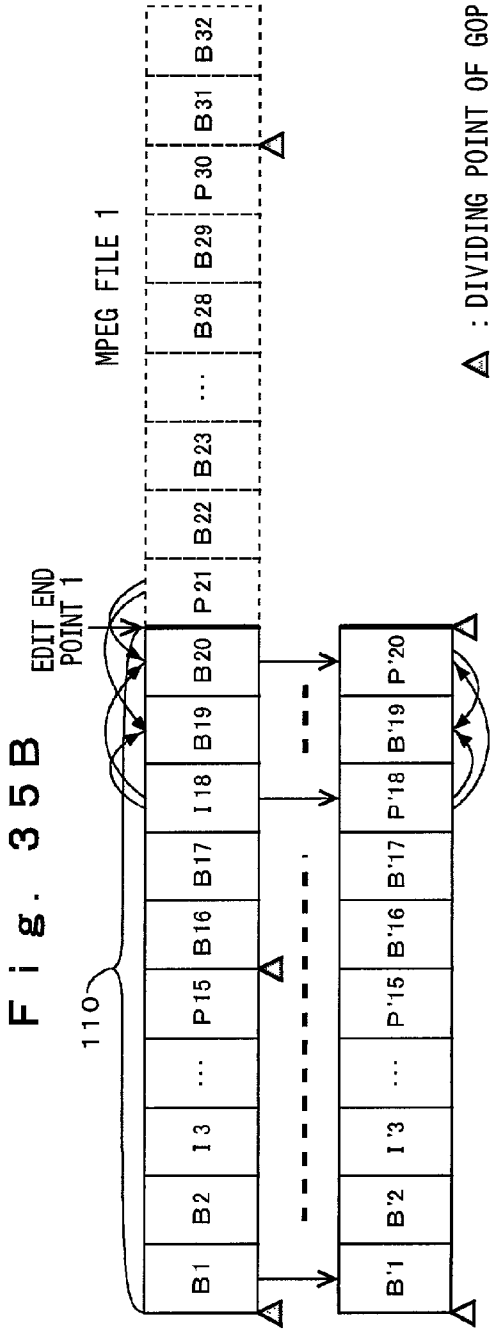


Fig. 35B

Fig. 36

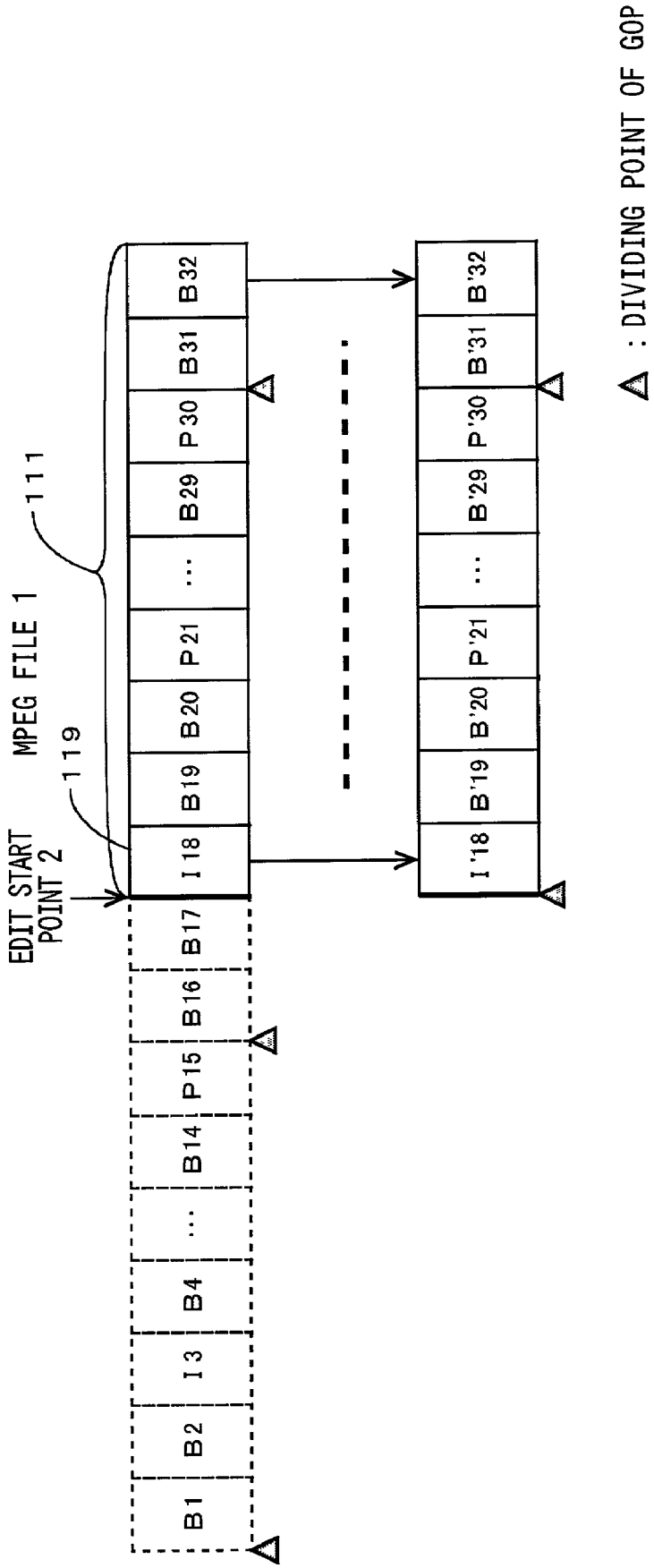

MPEG FILE 1
111
119
EDIT START POINT 2
B1
B2
I3
B4
...
B14
P15
B16
B17
I18
B19
B20
P21
...
B29
P30
B31
B32
I'18
B'19
B'20
P'21
...
B'29
P'30
B'31
B'32
: DIVIDING POINT OF GOP

Fig. 37A

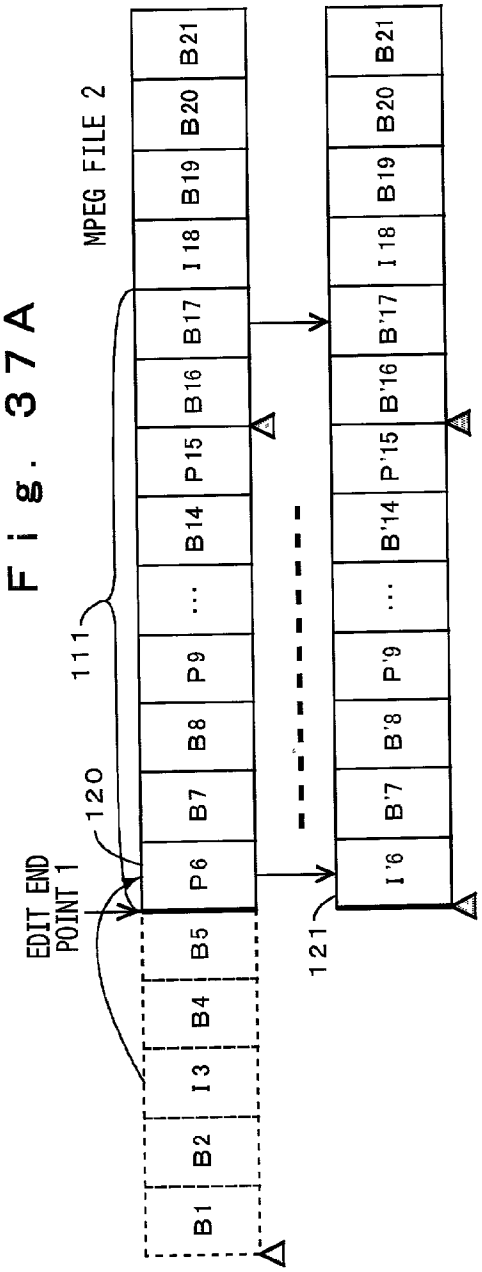
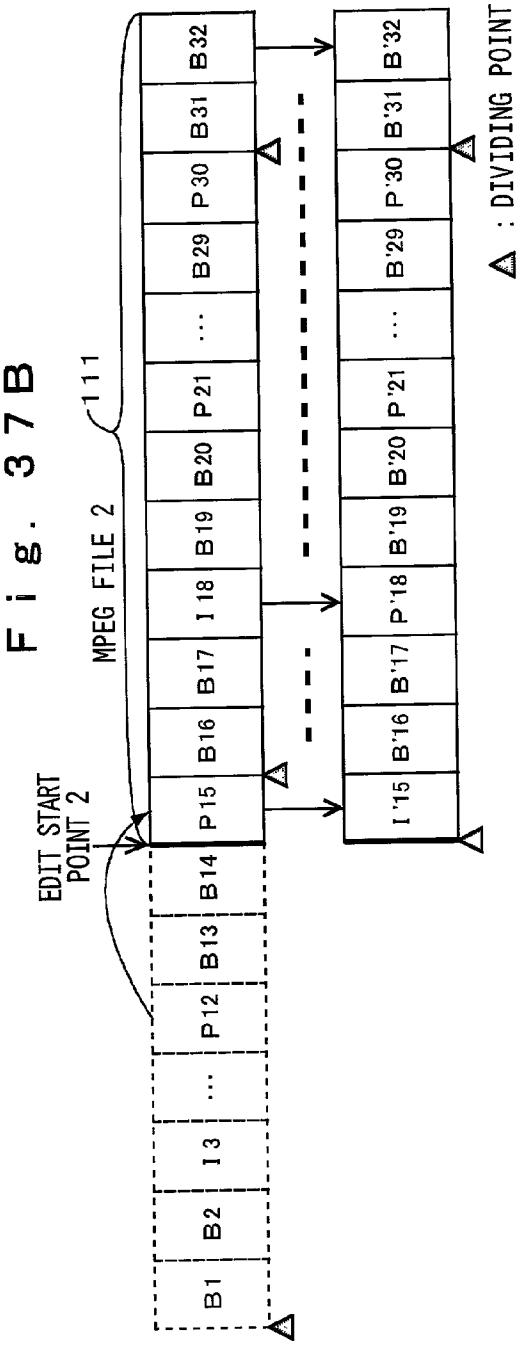


Fig. 37B



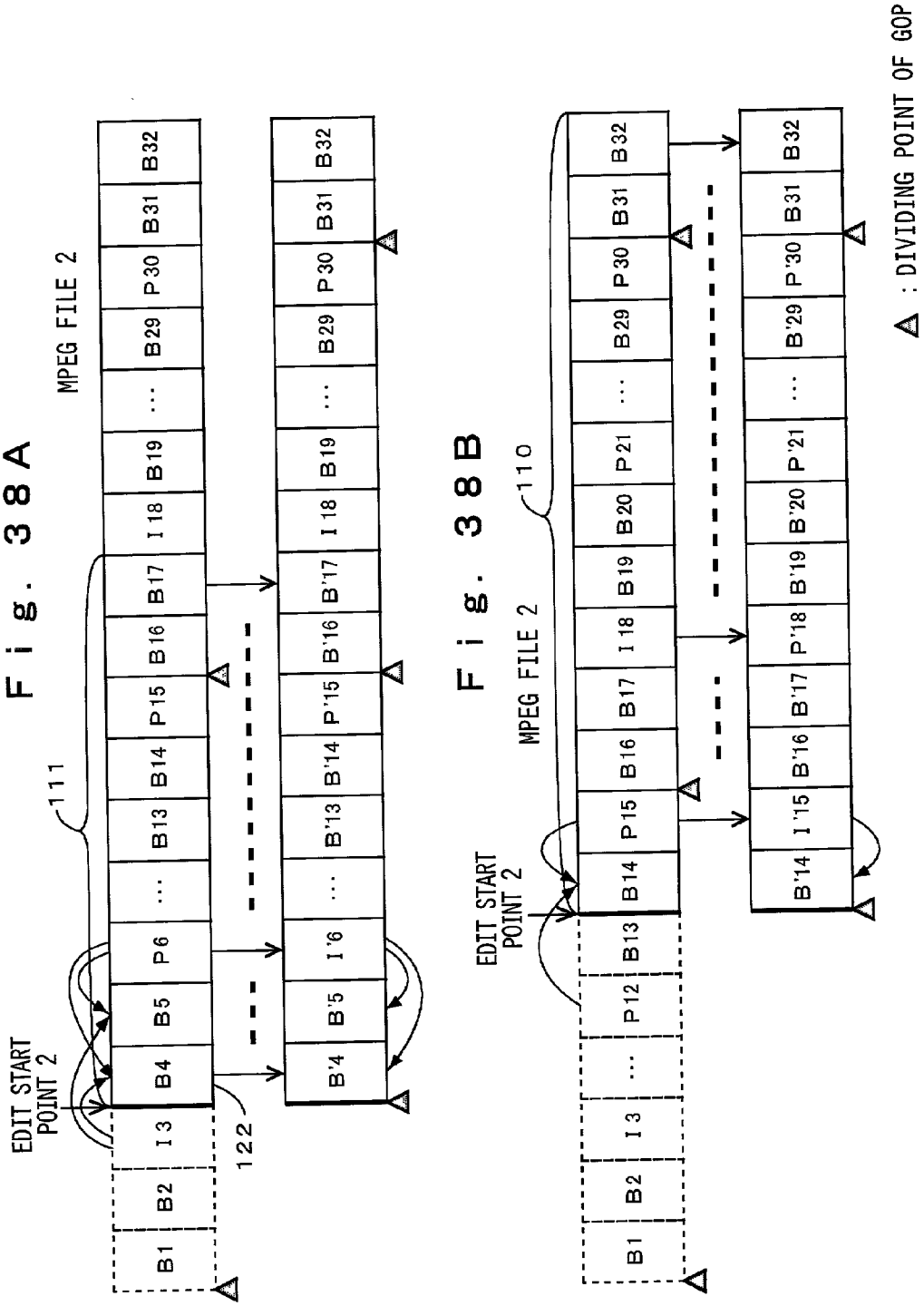
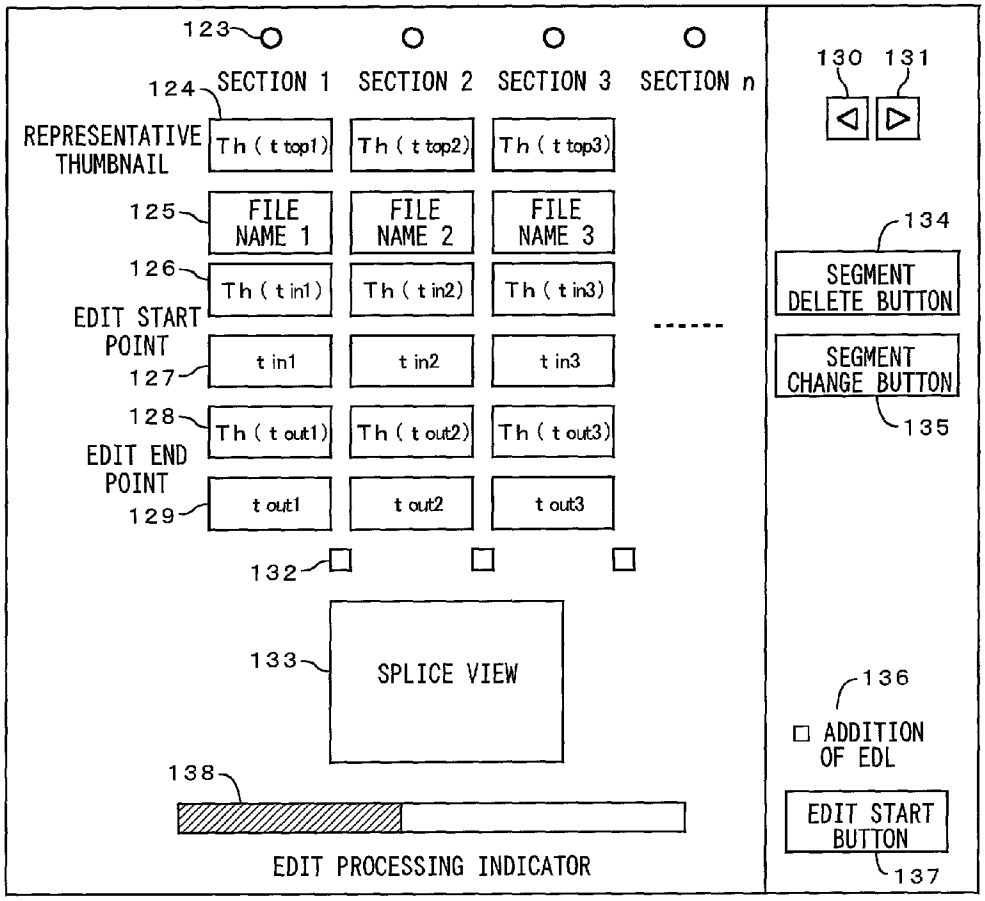


Fig. 38A
MPEG FILE 2
111
EDIT START POINT 2
122
B1 B2 I3 B4 B5 P6 ... B13 B14 P15 B16 B17 I18 B19 ... B29 P30 B31 B32
B'4 B'5 I'6 ... B'13 B'14 P'15 B'16 B'17 I18 B19 ... B29 P30 B31 B32
Fig. 38B
110
MPEG FILE 2
EDIT START POINT 2
B1 B2 I3 P12 ... B13 B14 P15 B16 B17 I18 B19 B20 P21 ... B29 P30 B31 B32
B'14 I'15 B'16 B'17 P'18 B'19 B'20 P'21 ... B'29 P'30 B'31 B32
△ : DIVIDING POINT OF GOP

Fig. 39


123
SECTION 1
SECTION 2
SECTION 3
SECTION n
124
REPRESENTATIVE THUMBNAIL
Th (t top1)
Th (t top2)
Th (t top3)
125
FILE NAME 1
FILE NAME 2
FILE NAME 3
126
Th (t in1)
Th (t in2)
Th (t in3)
EDIT START POINT
127
t in1
t in2
t in3
128
Th (t out1)
Th (t out2)
Th (t out3)
EDIT END POINT
129
t out1
t out2
t out3
132
133
SPLICE VIEW
138
EDIT PROCESSING INDICATOR
130
131
134
SEGMENT DELETE BUTTON
SEGMENT CHANGE BUTTON
135
136
ADDITION OF EDL
EDIT START BUTTON
137

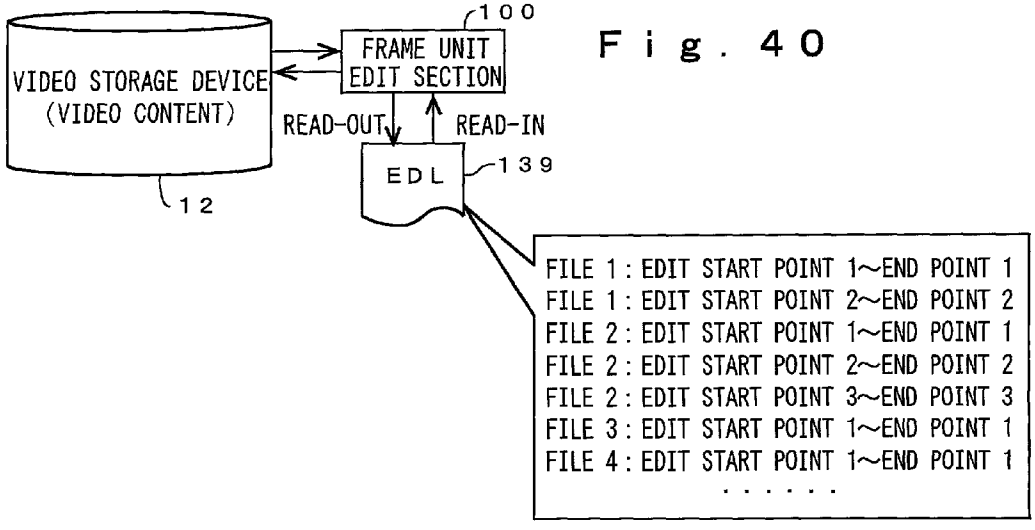

100
VIDEO STORAGE DEVICE (VIDEO CONTENT)
FRAME UNIT EDIT SECTION
READ-OUT
READ-IN
EDL
139
12
FILE 1 : EDIT START POINT 1~END POINT 1
FILE 1 : EDIT START POINT 2~END POINT 2
FILE 2 : EDIT START POINT 1~END POINT 1
FILE 2 : EDIT START POINT 2~END POINT 2
FILE 2 : EDIT START POINT 3~END POINT 3
FILE 3 : EDIT START POINT 1~END POINT 1
FILE 4 : EDIT START POINT 1~END POINT 1
. . . . . .

Fig. 40

Fig. 41

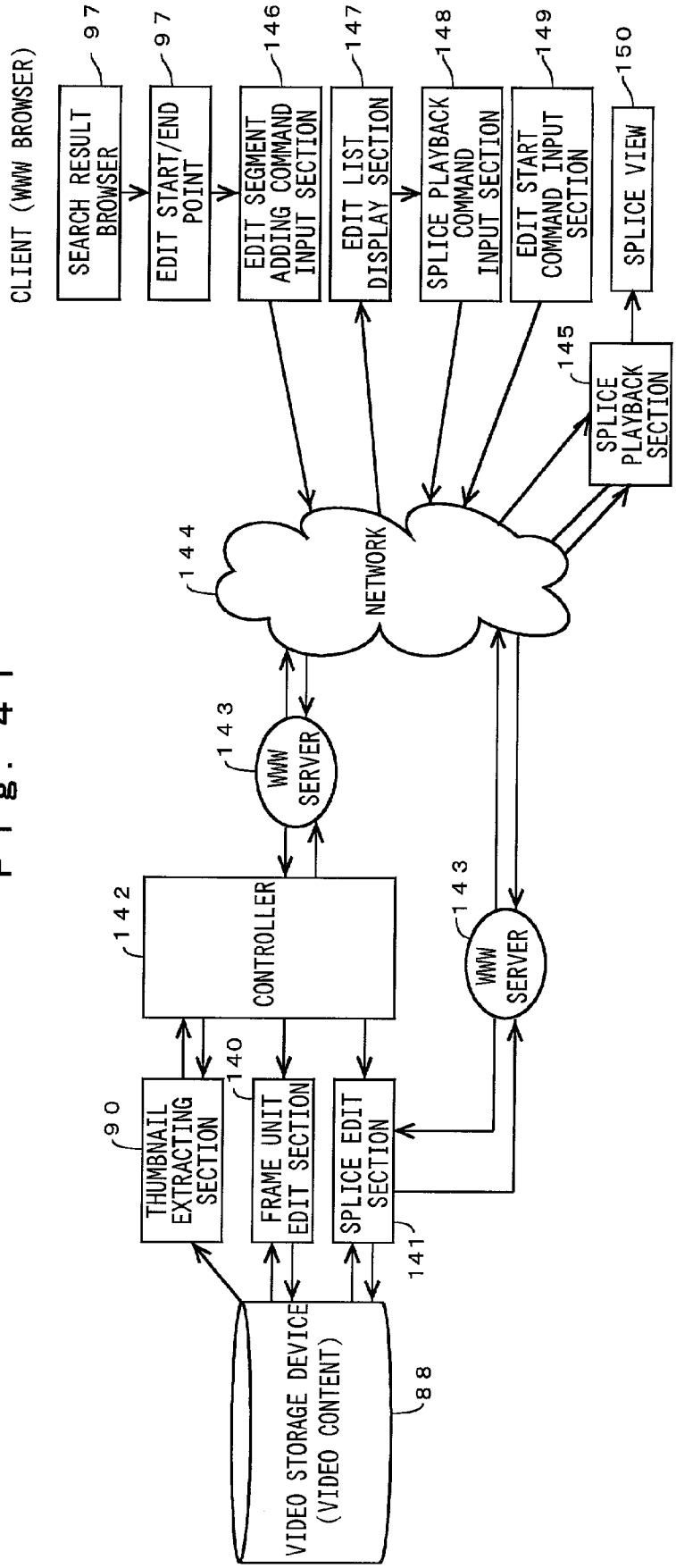
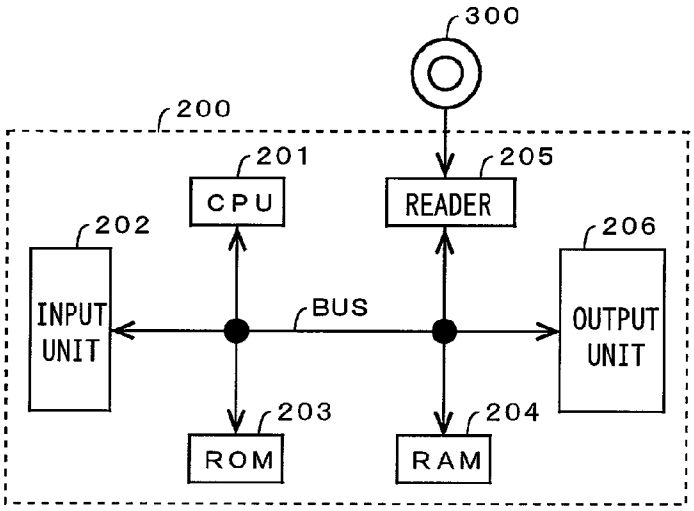

CLIENT (WWW BROWSER)
SEARCH RESULT BROWSER
97
EDIT START/END POINT
97
EDIT SEGMENT ADDING COMMAND INPUT SECTION
146
EDIT LIST DISPLAY SECTION
147
SPLICE PLAYBACK COMMAND INPUT SECTION
148
EDIT START COMMAND INPUT SECTION
149
SPLICE VIEW
150
SPLICE PLAYBACK SECTION
145
NETWORK
144
WWW SERVER
143
CONTROLLER
142
WWW SERVER
143
THUMBNAIL EXTRACTING SECTION
90
FRAME UNIT EDIT SECTION
140
SPLICE EDIT SECTION
141
VIDEO STORAGE DEVICE (VIDEO CONTENT)
88

Fig. 42



PRIOR ART

Fig. 43

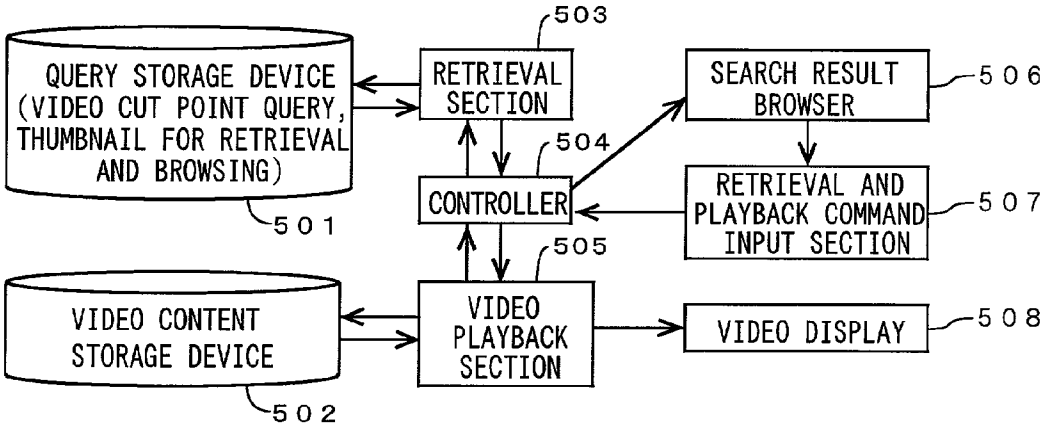
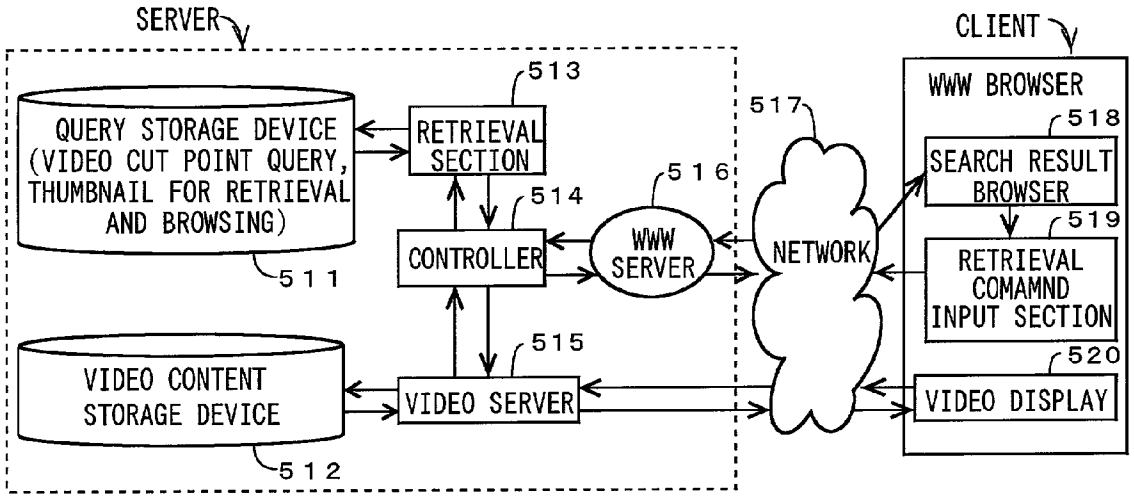


Fig. 44 PRIOR ART



VIDEO RETRIEVAL AND BROWSING APPARATUS, VIDEO RETRIEVAL, BROWSING AND EDITING APPARATUS, AND RECORDING MEDIUM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a retrieval and browsing apparatus for digital video contents such as MPEG, to a video retrieval, browsing and editing apparatus, which can effectively and precisely carry out edition processing of frame unit using thumbnail retrieval and browsing result, and to a recording medium storing programs used for them.

[0003] 2. Description of the Related Art

[0004] The first conventional example, that is, a local type video retrieval and browsing apparatus will be described below with reference to **FIG. 43**. In **FIG. 43, a** video content storage device **502** is previously stored with video contents. A query storage device **501** previously detects and saves queries or retrieval data such as cut points from the stored video by using any methods or means. Further, the query storage device **501** previously extracts and saves a browsing thumbnail still image such as JPEG file corresponding to a time code such as the cut point by using any methods or means.

[0005] In the case of retrieving the video contents, a retrieval and playback command input section **507** designates a video file name, and then, a retrieval start command is inputted to a controller **504**. Whereupon the controller **504** outputs a retrieval start time code and data on the number of retrievals of browsing thumbnail to a retrieval section **503**. The retrieval section **503** fetches the corresponding thumbnail sequence from the query storage device **501** based on the input data, and then, browse-displays it on a search result browser **506** via the controller **504**.

[0006] Regarding video playback, for example, a user instructs time codes desired to start and end the video playback on a browsing display of the search result browser **506**. Whereupon a playback command is inputted to the controller **504** via the retrieval and playback command input section **507** together with the playback start and end time codes and the video file name. Subsequently, these data is transmitted to a video playback section **505**. The video playback section **505** extracts a designated segment data of video contents designated by the video content storage device **502**, and then, transmits it to a video display **508**. Thereafter, the video display **508** carries out segment playback from the playback start point to the playback end point.

[0007] Next, the second conventional example, that is, a server client type video retrieval and browsing apparatus will be detailedly described below with reference to **FIG. 44**. The video contents stored in a video content storage device **512** and the query such as video cut point saved in a query storage device **511** are the same as the case of **FIG. 43**.

[0008] In the case of retrieving the video contents, a retrieval and playback command input section **519** on the client side designates a video file name, and then, a retrieval start command is inputted to a controller **514** via a network **517** and a WWW server **516**. Whereupon a retrieval start time code and the number of retrievals of browsing thumbnail are outputted to a retrieval section **513**. The retrieval section **513** fetches the corresponding thumbnail sequence from the query storage device **511** based on the input data, and then, transmits it to a search result browser **518** via the controller **514**, WWW server **516** and network **517**. The thumbnail sequence is browse-displayed on the search result browser **518**.

[0009] Regarding video playback, for example, a user instructs time codes desired to start and end the video playback on a browsing display of the search result browser **518**. Whereupon a playback command is transferred to a video server **515** from a retrieval and playback command input section **519** via the network **517** together with the playback start and end time codes and the video file name. Subsequently, the video server **515** extracts a designated segment data of designated video contents from the video content storage device **512**, and then, transmits it to a video display **520** via the network **517**. As a result, segment playback from the playback start point to the playback end point of the designated video content is carried out.

[0010] In the above first and second conventional examples, only specified thumbnail data is previously generated from the video query such as cut point. For this reason, it has been difficult to carry out thumbnail retrieval and browsing of frame unit or second unit, and segment playback by designating the time as playback start point and end point.

[0011] In order to solve the above problem, a method of previously generating thumbnails corresponding to all frames has been proposed. In this case, however, the total quantity of thumbnail data becomes larger than a quantity of data of the original video. As a result, the following problem arises; more specifically, two times or more storage capacity is required as compared with the case of storing only video data, and processing time for extracting the whole thumbnails is required.

[0012] Further, in the above first and second conventional examples, the cut point query has been used as query used for thumbnail retrieval and browsing. In this case, however, it is difficult to carry out thumbnail retrieval and browsing using query of a telop such as news, or audio classification data and segment playback designating the playback start point and the playback end point.

[0013] Next, the following is a description on a conventional video retrieval, browsing and editing apparatus. In retrieval, browsing and editing apparatus of the initial digital video contents, a digital video data stored in hard disk is fast-forwarded and rewound using a random access function of the hard disk, thereby, the edit point is designated, and thus, an edit work has been done. In this case, however, a great large of time has been spent in the case of editing long-time retrieval contents.

[0014] For example, in "the video retrieval and editing apparatus disclosed in Japanese Patent Application Laid-Open No. 10-66008" proposed by the present applicant, macro retrieval by cut point data and frame unit micro retrieval are combined, and thereby, it is possible to greatly shorten the time to designate the edit point.

[0015] However, it is impossible to precisely detect a telop appearing frame characterizing a semantic switchover in

scenes such as news video, and a point switching from human's voice to BGM. Further, there are many cases where much time and labor are inevitably taken to determine fine edit points depending on the video contents.

[0016] In the case of editing digital video contents of MPEG format on compressed data, it is possible to edit the digital video contents at a GOP (Group of Picture) unit; however, in the case of editing the contents at frame precision, all of frames are temporarily decoded, and thereafter, edit and re-compression must be carried out. In this case, a temporal saving disk for decoding is required, and a degradation of picture quality is generated by decoding and re-coding, and in addition, there is a possibility such that the editing process must be made for a long time.

[0017] In the case of inspecting the video data after being edited, in order to check subtle connection between image and voice on the joint portion, that is, edit points, all editing must be once completed. If a fail exists in the above editing, the following work must be repeatedly done; more specifically, the edit point is finely adjusted, and editing is again carried out, and then confirmation whether the fail is corrected is carried out.

[0018] Further, in the case where the user desires to retry the editing work once completed from the completed point of time, or in the case where the user desires to do a mutual editing work with another editing system, designation of video contents and preparation of each edit point list must be again carried out by manual.

SUMMARY OF THE INVENTION

[0019] The present invention has been made in view of the above problems. Accordingly, an object of the present invention is to provide a video retrieval and browsing apparatus, which can extract thumbnail data having a time necessary for browse-display from video files stored in a storage device using query in real time, and make without using a storage device for saving thumbnail data.

[0020] Further, another object of the present invention is to provide a video retrieval and browsing apparatus, which can perform thumbnail retrieval and browsing using query by telop such as news and audio classification data other than cut point query as query used for thumbnail retrieval and browsing and segment playback by designating playback start point and end point.

[0021] Further, another object of the present invention is to provide a recording medium recording a program for extracting thumbnail in real time.

[0022] Further, another object of the present invention is to provide a recording medium recording a retrieval and browsing control program for achieving retrieval and browsing complexly using cut point query, query by telop or query by audio classification.

[0023] Further, another object of the present invention is to provide a retrieval, browsing and editing apparatus, which can complexly carry out cut point retrieval, telop retrieval, audio classification or frame unit retrieval from video files stored in a storage device, and can effectively and precisely achieve frame unit editing using the thumbnail retrieval and browsing result.

[0024] Further, another object of the present invention is to provide a recording medium recording an editing processing program capable of achieving prevention of degradation of picture quality, temporary saving disk reduction by non-execution of the entire decoding, and high-speed processing by carrying out frame precision editing on MPEG compressed data in an editing process.

[0025] Further, another object of the present invention is to provide a recording medium recording a splice edit playback processing program for confirming visual consistency of a joint portion between edit points before execution of edit.

[0026] Further, another object of the present invention is to provide a retrieval, browsing and editing apparatus and a recording medium recording a processing program, which can input and output an edit segment list as EDL (Edit Decision List) conformable to SMPTE (Society of Motion Picture & Television engineers) in video editing, and thereby, can restart a previously completed edit work from the completed point of time, and perform mutual edit work with an external system.

[0027] In order to achieve the above described object, a first characteristic of present invention is that a video retrieval and browsing apparatus for retrieving and browsing a digital video content such as MPEG, comprising: time direction retrieval means for carrying out time direction retrieval of video content; thumbnail extracting means for extracting a thumbnail from the video content in real time based on the retrieval result of the time direction retrieval means; and search result browser for browse-displaying the retrieval result using the thumbnail extracted by the thumbnail extracting means. According to this characteristic, it is possible to realize thumbnail retrieval and browsing without previously preparing and saving thumbnail data. Further, it is possible to realize high-precise thumbnail retrieval and browsing at frame unit and second unit.

[0028] A second characteristic of present invention is that the video content is stored in a WWW server, and the time direction retrieval means and the thumbnail extracting means is provided in the WWW server. A third characteristic of present invention is that a WWW browser is connected to the WWW server via a network so that the WWW server can carry out video retrieval processing, and the WWW browser can designate retrieval conditions and browse-display the retrieval result. According to these characteristics, a thumbnail retrieval and editing processing is not only carried out on the local host computer, but also is carried out on the network in a state of having video data in common.

[0029] A fourth characteristic of present invention resides in a computer readable recording medium recording a thumbnail extracting processing program for extracting a thumbnail from a video content in real time based on the given time code sequence. According to this characteristic, the program recorded in the recording medium is read into the computer, and thereby, the present invention can be realized on computers such as personal computers.

[0030] A fifth characteristic of present invention is that a video retrieval, browsing and editing apparatus for editing a digital video content such as MPEG, comprises means for designating an edit start point and an edit end point using thumbnail retrieval and browsing result complexly using cut

point retrieval, telop retrieval, audio classification and frame unit retrieval. According to this characteristic, it is possible to effectively and accurately designate the edit start/end points using the cut point retrieval, the telop retrieval, the audio classification and the frame unit retrieval, and thereby, to achieve video frame unit edit.

[0031] A sixth characteristic of present invention is that the video retrieval, browsing and editing apparatus includes means for decoding only partial data before and after the edit point to base band, and editing and re-compressing it in the case of carrying out the frame unit edit processing of MPEG content in a state that the data other than the partial data before and after the edit point is intactly compressed data. According to this characteristic, it is possible to prevent degradation of picture quality, to reduce a temporary saving disk by non-execution of the entire decoding, and to realize high-speed processing, because only partial data before and after the edit point is decoded to base band and then is re-compressed.

[0032] Farther, a seventh characteristic of present invention resides in a computer readable recording medium recording a program for decoding only partial data before and after the edit point designated using the thumbnail retrieval and browsing result to base band, editing it at the edit point, and re-compressing the decoded data in the case of carrying out the frame unit edit processing of MPEG content. According to this characteristic, it is possible to provide a computer readable recording medium recording the program capable of preventing degradation of picture quality by non-execution of the entire decoding of MPEG content, reducing a temporary saving disk, and realizing high-speed processing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] **FIG. 1** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a first embodiment of the present invention;

[0034] **FIG. 2** is a view to explain a cut point query description;

[0035] **FIG. 3** is a block diagram to explain a function of thumbnail extracting section;

[0036] **FIG. 4** is a view to explain an MPEG frame structure;

[0037] **FIG. 5** is a view to explain a thumbnail extracting operation;

[0038] **FIG. 6** is a view showing an example of a cut point retrieval and browsing display;

[0039] **FIG. 7** is a view showing an example of a frame unit retrieval and browsing display;

[0040] **FIG. 8** is a view showing a relation between cut point time codes and frame unit time codes;

[0041] **FIG. 9** is a view showing a video index browser and video player of the first embodiment;

[0042] **FIG. 10** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a second embodiment of the present invention;

[0043] **FIG. 11** is a view to explain a telop query description;

[0044] **FIG. 12** is a view showing a telop retrieval and browsing display;

[0045] **FIG. 13** is a view showing a relation between telop start point time codes and frame unit time codes;

[0046] **FIG. 14** is a view showing an example of a video index browser and video player of the second embodiment;

[0047] **FIG. 15** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a third embodiment of the present invention;

[0048] **FIG. 16** is a view to explain an audio classification data description;

[0049] **FIG. 17** is a view showing an example of an audio classification retrieval and browsing display;

[0050] **FIG. 18** is a view showing a relation between audio classification point time codes and frame unit time codes;

[0051] **FIG. 19** is a view showing an example of a video index browser and video player of the third embodiment;

[0052] **FIG. 20** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a fourth embodiment of the present invention;

[0053] **FIG. 21** is a view showing an example of a combined display of a cut point browser and an audio classification browser;

[0054] **FIG. 22** is a view showing an example of a video index browser and video player of the fourth embodiment;

[0055] **FIG. 23** is a view schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a fifth embodiment of the present invention;

[0056] **FIG. 24** is a view showing an example of a combined display of a telop retrieval browser and an audio classification browser;

[0057] **FIG. 25** is a view showing an example of a video index browser and video player of the fifth embodiment;

[0058] **FIG. 26** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to a sixth embodiment of the present invention;

[0059] **FIG. 27** is a view showing an example of a video index browser and video player of the fifth embodiment;

[0060] **FIG. 28** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (server client type) according to a seventh embodiment of the present invention;

[0061] **FIG. 29** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (local type) according to an eighth embodiment of the present invention;

[0062] **FIG. 30** is a view to explain frame unit edit on compressed data of MPEG contents;

[0063] **FIG. 31** is a view showing a relation between a stream picture order and a display picture order in MPEG;

[0064] **FIG. 32** is a view to explain frame unit edit on MPEG compression;

[0065] **FIG. 33** is a view to explain frame unit edit (the edit point former half) on MPEG compression;

[0066] **FIG. 34**A and **FIG. 34B** are views to explain another frame unit edit (the edit point former half) on MPEG compression;

[0067] **FIG. 35**A and **FIG. 35B** are views to explain another frame unit edit (the edit point former half) on MPEG compression;

[0068] **FIG. 36** is a view to explain frame unit edit (the edit point latter half) on MPEG compression;

[0069] **FIG. 37**A and **FIG. 38B** are views to explain another frame unit edit (the edit point latter half) on MPEG compression;

[0070] **FIG. 38**A and **FIG. 38B** are views to explain another frame unit edit (the edit point latter half) on MPEG compression;

[0071] **FIG. 39** is a view showing an example of an edit control display screen of the eighth embodiment;

[0072] **FIG. 40** is a view to explain editing by EDL files;

[0073] **FIG. 41** is a block diagram schematically showing a configuration of video retrieval and browsing apparatus (server client type) according to a ninth embodiment of the present invention;

[0074] **FIG. 42** is a block diagram showing a configuration of program readable computer of the present invention;

[0075] **FIG. 43** is a block diagram showing a configuration of conventional video retrieval and browsing apparatus (local type); and

[0076] **FIG. 44** is a block diagram showing a configuration of another conventional video retrieval and browsing apparatus (server client type).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0077] The present invention will be described below in detail with reference to the accompanying drawings. First, a first embodiment of the present invention, that is, a local type video retrieval and browsing apparatus will be described with reference to a block diagram shown in **FIG. 1**.

[0078] [First Embodiment]

[0079] According to this first embodiment, thumbnail is extracted in real time from a video using cut point query or frame unit and second unit time code sequence, and thereby, it is possible to carry out high precision thumbnail retrieval and browsing at frame unit and second unit. Further, the time is designated as playback start/end point, and thereby, it is possible to carry out high precision segment playback on local host computer without using an additional storage device for saving the entire thumbnail data.

[0080] In **FIG. 1, a** video storage device **12** is previously stored with video contents. A cut point query showing a break of scene is previously detected from the video contents stored in the video storage device **12**, and thereafter, it is saved in a query storage device **11**. The cut point query is composed of a cut point browsing time code sequence **20**, as described later with reference to **FIG. 2**. In this first embodiment, the important matters are as follows; more specifically, there is no need of previously extracting browsing thumbnails such as JPEG files corresponding to time codes included in the cut point query from the video contents as done in the conventional retrieval and browsing apparatus, and previously saving them in the query storage device **11**.

[0081] The method described in "video cut point detecting apparatus disclosed in Japanese Patent Application Laid-Open No. 11-252509" by the present applicant may be employed as the method for retrieving the cut point query. As shown in **FIG. 2, a** cut point browsing time code sequence (C**1**, C**2**, C**3**, . . .) **20** is used as the cut point query description. In the cut point browsing time code sequence **20**, cut points and detected time codes are arranged in time series order.

[0082] When a video file name is designated from a retrieval and playback command input section **18** of **FIG. 1**, and a cut point retrieval start command is inputted, a controller **15** outputs a cut point start time code and the number of retrievals of a cut point browsing thumbnail to a retrieval section **13**. The retrieval section **13** obtains a cut point browsing time code sequence corresponding to the thumbnails to be browsed from the cut point query saved in the query storage device **11** based on the inputted data, and then, outputs it to the controller **15**. The controller **15** transfers the obtained cut point browsing time code sequence to a thumbnail extracting section **14**, and then, fetches the corresponding thumbnail sequence from the thumbnail extracting section **14**, and thereafter, the fetched thumbnail sequence is browse-displayed as the cut point retrieval result on a search result browser **17** via the controller **15**.

[0083] In the case of retrieving and browsing further detailed contents in a time direction from a cut point position or arbitrary position, the retrieval and playback command input section **18** inputs the following information to the controller **15**. More specifically, the information includes time codes of the detailed retrieval and browsing start position, display precision of time directions such as frame unit and second unit, and the number of retrievals of browsing thumbnail. Then, the controller **15** generates a browsing time code sequence having a predetermined time interval from the obtained data, and thereafter, transfers the browsing time code sequence to the thumbnail extracting section **14**. Further, the corresponding thumbnail sequence is fetched, and then, is browse-displayed as the retrieval result of predetermined time interval on the search result browser **17** via the controller **15**.

[0084] In the case of carrying out video segment playback, a video playback start time code and a video playback end time code are commanded on the browse-display of the search result browser **17**. Whereupon the retrieval and playback command input section **18** inputs frame precision playback start and end time codes and playback start command data including video file name data to the controller **15**. These data is transferred from the controller **15** to the video playback section **16**. The video playback section **16**

extracts a designated segment data of designated video contents, and thereafter, the video display **19** carries out segment playback from a playback start point to a playback end point. By doing so, frame precision local segment playback is possible.

[**0085**] The operation of the thumbnail extracting section **14** will be described in detail with reference to the conceptual views shown in **FIG. 3** and **FIG. 4**. The thumbnail extracting section **14** is composed of a video partial decode section **22**, a cache **23** and a thumbnail generating section **24**. When a request time code and the number of retrievals of thumbnail are inputted to the controller **15**, the controller **15** confirms whether or not the corresponding thumbnail exists in the cache **23**, and then, if it exists therein, the cache **23** outputs the corresponding thumbnail via a switch **26**. On the other hand, unless the corresponding thumbnails exists therein, data is read from a video file **20** of the video storage device **12** via a switch **25**, and then, the video partial decode section **22** partially decodes only necessary frame, and thereafter, the thumbnail generating section **24** generates a thumbnail such as JPEG or the like. The thumbnail thus generated is outputted via the switch **26** while being temporarily saved in the cache **23**.

[**0086**] In the case where the video compression format is MPEG, the MPEG frame structure is composed of an intra-frame coding I picture, inter-frame coding P and B pictures, as shown in **FIG. 4**. Therefore, in the case where a requested time code indicates an inter-frame coding portion, the preceding one or more frame must be decoded. For this reason, there is a possibility such that decoding of the same frame overlaps; as a result, a processing efficiency is reduced. In order to avoid the above disadvantage, a video partial decode minimum unit is set as GOP (Group of Pictures), and all frames of the GOP including the request time code are decoded, and further, a thumbnail having the request time code is outputted while being saved in the cache **23**. By doing so, in the case where the next request time code is close to the previous request time code, a probability of secondarily using the cached thumbnail becomes high; therefore, a processing speed can be improved.

[**0087**] Next, mapping between requested time codes, video frame time codes and extracted thumbnail time codes in the thumbnail extracting section **14** will be described in detail with reference to **FIG. 5**. In a request time code sequence **27** (R1, R2, R3, R4,) having a predetermined time interval such as thumbnail cut point to be browsed or frame unit, a request time code is arranged in the order of time series, and the corresponding adaptable thumbnail sequence (Th(R1), Th(R2), Th(R3), Th(R4),) is extracted from these data.

[**0088**] A thumbnail Th(Rm) corresponding to m request time code Rm [sec] is determined in the following manner; more specifically, tn satisfying the following equation (1) is set as a time fetching the thumbnail corresponding to the m request time code. Namely, in the case of cut point thumbnail extraction, m cut point time code Cm [sec] is set as request time code Rm [sec], and then, a thumbnail Th(tn) generated from the video frame having tn [sec] time code is used as the output thumbnail Th(Rm) as shown with the following equation (2).

[**0089**] In this case, tn denotes n frame time code of the frame time code sequence (t1, t2, t3, . . . tk) **29** included in a video sequence **28**. For example, in the case of NTSC video signal, tn is obtained from the following equation (3).

$$tn \leqq Rm < tn+1[\text{sec}] \quad (1)$$

$$Th(Rm)=Th(\text{tn}) \quad (2)$$

$$tn=(1/29.97)\times n[\text{sec}](n=0, 1, 2,) \quad (3)$$

[**0090**] In the case of extracting a thumbnail from video contents compressed in the format of MPEG, in view of the compression format, the leading frame of GOP (Group of Pictures) including the frame equivalent to the time tn must be decoded so that the corresponding thumbnail can be extracted.

[**0091**] Next, the following is a description on browsing display and playback display of the search result browser **17** (see **FIG. 1**). **FIG. 6** shows a browsing display example of cut point retrieval and browsing. A cut point time code sequence (Cn, Cn+1, Cn+2, Cn+3, Cn+4) **30** is displayed, and simultaneously, a cut point thumbnail sequence (Th(Cn), Th(Cn+1), Th(Cn+2), Th(Cn+3), Th(Cn+4)) is displayed in synchronous with the above display. When pushing a left skip button **32**, a cut point time code sequence (Cn−5, Cn−4, Cn−3, Cn−2, Cn−1) and a cut point thumbnail sequence (Th(Cn−5), Th(Cn−4), Th(Cn−3), Th(Cn−2), Th(Cn−1)) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **33**, a time code sequence (Cn+5, Cn+6, Cn+7, Cn+8, Cn+9) after one span of the presently displaying time code sequence and a cut point thumbnail sequence (Th(Cn+5), Th(Cn+6), Th(Cn+7), Th(Cn+8), Th(Cn+9)) are displayed.

[**0092**] **FIG. 7** shows a browsing display example of frame unit retrieval and browsing. A frame unit time code sequence (Fn, Fn+1, Fn+2, Fn+3, Fn+4) **34** is displayed, and simultaneously, a frame unit thumbnail sequence (Th(Fn), Th(Fn+1), Th(Fn+2), Th(Fn+3), Th(Fn+4)) **35** is displayed in synchronous with the above display. When pushing a left skip button **36**, a time code sequence (Fn−5, Fn−4, Fn−3, Fn−2, Fn−1) and a thumbnail sequence (Th(Fn−5), Th(Fn−4), Th(Fn−3), Th(Fn−2), Th(Fn−1)) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **37**, a time code sequence (Fn+5, Fn+6, Fn+7, Fn+8, Fn+9) and a thumbnail sequence (Th(Fn+5), Th(Fn+6), Th(Fn+7), Th(Fn+8), Th(Fn+9)) after one span of the presently displaying time code sequence are displayed. The frame unit time code browsing display is made using a browsing interval setup menu **40** of **FIG. 9**. For example, the frame unit time code is changed to a value having equal intervals such as GOP unit, one-second unit, and five-second unit, and thereby, equal interval browsing display is possible with various time precisions.

[**0093**] Further, as seen from **FIG. 8** showing a relation between cut point time codes and frame unit time codes, the browsing display in the cut point retrieval and browsing is combined with the equal interval browsing display such as frame unit. By doing so, a time position is roughly specified by the cut point browsing display, and thereafter, time codes can be finely displayed from the time position by the frame unit browsing display.

[**0094**] **FIG. 9** shows an example of a video index browser and video player singly or complexly using a cut point browser and a frame unit browser.

[0095] A cut point browser **38** is operated in the same manner as the browser described in **FIG. 6**. The cut point browser **38** is suitable to roughly grasp the contents, and can designate playback start and end positions. In a state of extracting a thumbnail of certain time position on the cut point browser **38**, when pushing a playback start time point button **42**, the time code is displayed on a playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing a playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing a playback start button **45**, segment playback from the start point to end point designated by the cut point is started on a playback display screen **46**. In the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back by the cut point designation.

[0096] On the other hand, a frame unit browser **39** is operated in the same manner as the browser described in **FIG. 7**. When opening a browsing interval setup menu **40**, a display time interval such as frame unit, GOP (usually, about 0.5 seconds) unit and five-second unit is displayed, and then, the display is extracted, and thereby, the display time interval can be changed. Hereinafter, the frame unit browser **39** includes a frame unit browsing function; therefore, it is referred to as equal interval browser.

[0097] In the cut point browser **38**, when extracting a certain thumbnail, equal interval browsing display from the time is made on the equal interval browser **39**, and then, time direction contents are finely grasped while playback start and end position being designated. In a state of extracting a thumbnail of certain time position on the equal interval browser **39**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing a playback start button **45**, segment playback from the designated start point to end point designated by the frame precision is started on the playback display screen **46**. In the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back by the cut point designation.

[0098] As described above, according to the first embodiment of the video retrieval and browsing apparatus, on the cut point browser **38**, it is possible to carry out rough thumbnail retrieval and browsing; on the other hand, on the equal interval browser, it is possible to carry out high precise thumbnail retrieval and browsing at frame unit and second unit. Further, on the equal interval browser **39**, it is possible to carry out high precise segment playback by designating the time as playback start and end points. Moreover, the query storage device **11** has no need of previously storing browsing thumbnail such as JPEG; therefore, it is possible to greatly reduce a storage capacity of the query storage device **11**.

[0099] [Second Embodiment]

[0100] Next, the following is a description on a second embodiment of the video retrieval and browsing apparatus. According to this second embodiment, thumbnail retrieval and browsing is carried out using telop query in place of the cut point query described in the above first embodiment, and high precise segment playback is carried out on a local host computer by designating the time as playback start/end point.

[0101] In **FIG. 10**, the video retrieval and browsing apparatus has the same configuration as **FIG. 1** excepting a query storage device **47**, and is operated in the same manner as that.

[0102] A telop query describing a start time of telop scene such as news is previously detected from a video stored previously in the video storage device **12**, and then, is stored in the query storage device **47**. In this case, there is no need of extracting and saving browsing thumbnail such as JPEG file corresponding to each telop start time code described in the telop query. The telop may be retrieved using the method described in "the intra-video telop area detecting apparatus disclosed in Japanese Patent Application No. 2000-248794" by the present applicant.

[0103] In the telop query description, a telop start point browsing time code sequence (T1, T2, T3, . . .) **48** as shown in **FIG. 11** is used. In the telop start point browsing time code sequence **48**, time codes showing the start of scene in which telop appears are arranged in the order of time series in the same manner as the cut point query description (see **FIG. 2**).

[0104] When a video file name is designated from the retrieval and playback command input section **18** and a telop retrieval start command is inputted, the controller **15** outputs telop retrieval start time code and the number of retrievals of telop start point browsing thumbnail to the retrieval section **13**. Then, based on the inputted data, the retrieval section **13** obtains a telop start point browsing time code sequence corresponding to thumbnail to be browsed from the telop query stored in the query storage device **47**. The controller **15** transfers the obtained telop start point browsing time code sequence to the thumbnail extracting section **14**, and then, the corresponding thumbnail sequence is fetched, and thereafter, is displayed as the telop start point retrieval result on the search result browser **17** via the controller **15**.

[0105] The method of retrieving and browsing finer contents in time direction from the telop start point position or arbitrary position and the video segment playback method are the same as the above first embodiment.

[0106] In the thumbnail extracting section **14**, mapping between requested time code, frame time code in the video and extracted thumbnail time code is the same as the above first embodiment. Namely, mapping is carried out by substituting the telop start point browsing time code sequence (T1, T2, T3, . . .) **48** shown in **FIG. 11** for the request time code sequence (R1, R2, R3, R4, . . .) **27** in **FIG. 5**.

[0107] **FIG. 12** shows a browsing display example of telop retrieval and browsing. The telop start point browse

time code sequence (Tn, Tn+1, Tn+2, Tn+3, Tn+4) **49** is displayed, and simultaneously, a telop start point thumbnail sequence (Th(Tn), Th(Tn+1), Th(Tn+2), Th(Tn+3), Th(Tn+4)) **50** is displayed in synchronous with the above display. When pushing a left skip button **51**, a time code sequence (Tn−5, Tn−4, Tn−3, Tn−2, Tn−1) and a telop start point thumbnail sequence (Th(Tn−5), Th(Tn−4), Th(Tn−3), Th(Tn−2), Th(Tn−1)) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **52**, a time code sequence (Tn+5, Tn+6, Tn+7, Tn+8, Tn+9) and a telop start point thumbnail sequence (Th(Tn+5), Th(Tn+6), Th(Tn+7), Th(Tn+8), Th(Tn+9)) after one span of the presently displaying time code sequence are displayed.

[**0108**] Further, as seen from **FIG. 13** showing a relation between telop start point time codes and frame unit time codes, the browsing display in the telop retrieval and browsing is combined with the equal interval browsing display such as frame unit described in the first embodiment (see **FIG. 7**). By doing so, a time position (such as head position of each item in news) is roughly specified by the telop start point browsing display, and thereafter, time codes can be finely displayed from the time position by the frame unit browsing display.

[**0109**] **FIG. 14** shows an example of a video index browser and video player singly or complexly using a telop retrieving browser and a frame unit browser.

[**0110**] The telop retrieving browser **53** is the same operation as that described in **FIG. 12**. The telop retrieving browser **53** cues up each item in news video having a probability such that telop appears in the beginning of scene changed, and can designate playback start and end positions. In a state that a thumbnail of certain position is selected on the telop retrieving browser **53**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing the playback start button **45**, segment playback from the start point to end point designated by telop start point is started on the playback display screen **46**. In the case where the playback start button **45** is pushed in a state of designating only playback start position, the segment playback from the designated start point to the last of contents is carried out. On the other hand, in the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back.

[**0111**] The operation of the equal interval browser **39** making the frame unit display is the same as the above first embodiment.

[**0112**] [Third Embodiment]

[**0113**] Next, the following is a description on a third embodiment of the video retrieval and browsing apparatus. According to this third embodiment, thumbnail retrieval and browsing is carried out using audio classification data in place of the cut point query described in the above first embodiment, and high precise segment playback is carried out on a local host computer by designating the time as playback start/end point.

[**0114**] In **FIG. 15**, the video retrieval and browsing apparatus has the same configuration as **FIG. 1** excepting a query storage device **54**, a retrieval section **55**, a controller **56** and a search result browser **57**, and is operated in the same manner as that. Audio classification data showing where audio belongs to any classes of voice, music, cheer noise and no sound is previously detected from video image previously stored in the video storage device **12**, and then, the detected data is saved in the query storage device **54**. In this case, there is no need of extracting and saving browsing thumbnail such as JPEG file corresponding to classification point time code described in the audio classification data. The audio data may be classified using the method described in "the audio data classifying apparatus disclosed in Japanese Patent Application Laid-Open No. 2000-66691" by the present applicant.

[**0115**] In the audio classification data, an audio classification data sequence (A1:AC1, A2:AC2, A3:AC3, . . .) **58** such as every one second as shown in **FIG. 16** is used. In this case, the audio data is classified into data such as "voice", "music", "cheer noise" and "no sound". In **FIG. 16, a** symbol "An" denotes n audio classification point time code, and a symbol "ACn" denotes an audio classifying data in n audio classification point.

[**0116**] When a video file name is designated from the retrieval and playback command input section **18** and an audio classification start command is inputted, the controller **56** outputs an audio classification start time code and the number of retrievals of audio classification point browsing thumbnail to the retrieval section **55**. Then, based on the inputted data, the retrieval section **55** obtains an audio classification point browsing time code sequence (An, An+1, An+3,) corresponding to thumbnail to be browsed and an audio classifying data sequence (ACn+1, ACn+2, ACn+3,) corresponding to each time code sequence from the audio classification data stored in the query storage device **54**. The controller **56** transfers the obtained audio classification point browsing time code sequence (An, An+1, An+3, . . .) to the thumbnail extracting section **14**, and then, the corresponding thumbnail sequence (Th(An), Th(An+1), Th(An+3), . . .) is fetched. Thereafter, the fetched thumbnail sequence is browse-displayed as the audio classification point retrieval result on the search result browser **57** together with the audio classifying data sequence (ACn+1, ACn+2, ACn+3,) via the controller **56**.

[**0117**] The method of retrieving and browsing finer contents in time direction from the audio classification point position or arbitrary position and the video segment playback method are the same as the above first embodiment.

[**0118**] In the thumbnail extracting section **14**, mapping between requested time code, frame time code in the video and extracted thumbnail time code is the same as the above first embodiment. Namely, mapping is carried out by substituting the audio classification point time code sequence (A1, A2, A3, . . .) **58** shown in **FIG. 16** for the request time code sequence (R1, R2, R3, R4, . . .) **27** in **FIG. 5**.

[**0119**] **FIG. 17** shows a browsing display example of audio classification. An audio classification point time code

sequence (An, An+1, An+2, An+3, An+4) **59** is displayed, and simultaneously, an audio classification point thumbnail sequence (Th(An), Th(An+1), Th(An+2), Th(An+3), Th(An+4)) **60** and an audio classification data sequence (ACn, ACn+1, ACn+2, ACn+3, ACn+4) **61** are displayed in synchronous with the above display. When pushing a left skip button **62**, a time code sequence (An−5, An−4, An−3, An−2, An−1), an audio classification point thumbnail sequence (Th(An−5), Th(An−4), Th(An−3), Th(An−2), Th(An−1)) and an audio classification data sequence (ACn−5, ACn−4, ACn−3, ACn−2 ACn−1) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **63** a time code sequence (An+5, An+6, An+7, An+8, An+9), an audio classification point thumbnail sequence (Th(An+5), Th(An+6), Th(An+7), Th(An+8), Th(An+9)) and an audio classification data sequence (ACn+5, ACn+6, ACn+7, ACn+8 ACn+9) after one span of the presently displaying time code sequence are displayed.

[**0120**] Moreover, in the frame unit retrieval browsing described in the above first embodiment, as seen from the relation between audio classification data point time codes and frame unit time codes of **FIG. 18**, audio classification browsing display is combined with equal interval browsing display such as frame unit. By doing so, a rough time position (e.g., point changing from MC's voice to musician's playing) is specified by the audio classification point browsing display, and then, the time code may be finely displayed from the position by the frame time browsing display.

[**0121**] **FIG. 19** shows an example of a video index browser and video player singly or complexly using the audio classification browser and the frame unit browser.

[**0122**] An audio classification browser **64** is the same operation as that described in **FIG. 17**. The audio classification browser **64** displays a scene changing point by voice classification using thumbnail and audio classification data, and can designate playback start and end positions. In a state that a thumbnail of certain position is selected on the audio classification browser **64**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing the playback start button **45**, segment playback from the start point to end point designated by the audio classification data changing point is started on the playback display screen **46**. In the case where the playback start button **45** is pushed in a state of designating only playback start position, the segment playback from the designated start point to the last of contents is carried out. On the other hand, in the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back.

[**0123**] The operation of the equal interval browser **39** making the frame unit display is the same as the above first embodiment; therefore, the details are omitted.

[**0124**] [Fourth Embodiment]

[**0125**] Next, the following is a description on a fourth embodiment of the video retrieval and browsing apparatus. According to this fourth embodiment, thumbnail retrieval and browsing and high precise segment playback by designating the time as playback start/end point are carried out on a local host computer using complexly the cut point query described in the above first embodiment and the audio classification data described in the above third embodiment.

[**0126**] In **FIG. 20**, the video retrieval and browsing apparatus has the same configuration as **FIG. 1** excepting a query storage device **65**, a retrieval section **66**, a controller **67** and a search result browser **68**, and is operated in the same manner as that. The query storage device **65** is stored with cut point query and audio classification data. The retrieval section **66**, the controller **67** and the search result browser **68** individually include all functions described in the above first and third embodiments.

[**0127**] **FIG. 21** shows an example of a complex browsing display of the cut point browser and the audio classification browser. In **FIG. 21**, the operation of the cut point time code sequence **30** and the cut point thumbnail sequence **31** are the same as that of **FIG. 6**. An audio classification data sequence (AC(Cn) AC(Cn+1), AC(Cn+2), AC(Cn+3), AC(Cn+4), . . .) **81** corresponding to the cut point time code sequence is displayed synchronous with the cut point time code sequence (Cn, Cn+1, Cn+2, Cn+3, Cn+4) **30** and the cut point thumbnail sequence (Th(Cn), Th(Cn+1), Th(Cn+2), Th(Cn+3), Th(Cn+4)). When pushing a left skip button **32**, a time code sequence (Cn−5, Cn−4, Cn−3, Cn−2, Cn−1), a cut point thumbnail sequence (Th(Cn−5), Th(Cn−4), Th(Cn−3), Th(Cn−2), Th(Cn−1)) and an audio classification data sequence (AC(Cn−5), AC(Cn−4), AC(Cn−3), AC(Cn−2), AC(Cn−1)) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **33**, a time code sequence (Cn+5, Cn+6, Cn+7, Cn+8, Cn+9), a cut point thumbnail sequence (Th(Cn+5), Th(Cn+6), Th(Cn+7), Th(Cn+8), Th(Cn+9)) and an audio classification data sequence (AC(Cn+5), AC(Cn+6), AC(Cn+7), AC(Cn+8), AC(Cn+9))after one span of the presently displaying time code sequence are displayed. In this case, the audio classification data AC(Cn) in the cut point time Cn is obtained from ACm (m audio classification data) shown in the following equation (5) using m (m audio classification point) satisfying the following equation (4).

$$Am \leqq Cn < Am+1 \tag{4}$$

$$AC(Cn) = ACm \tag{5}$$

[**0128**] **FIG. 22** shows a video index browser and video player complexly using the cut point browser, the audio classification browser and the frame unit browser.

[**0129**] A cut point retrieval and audio classification complex browser **80** is the same operation as that described in **FIG. 21**. The complex browser **80** displays a scene changing point by the cut point using thumbnail and audio classification data, and can designate playback start and end positions. In a state that a thumbnail of certain position is selected on the complex browser **80**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the

corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing the playback start button **45**, segment playback from the start point to endpoint designated by the cut point is started on the playback display screen **46**. In the case where the playback start button **45** is pushed in a state of designating only playback start position, the segment playback from the designated start point to the last of contents is carried out. On the other hand, in the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back.

[**0130**] The operation of the equal interval browser **39** making the frame unit display is the same as the above first embodiment; therefore, the details are omitted.

[**0131**] [Fifth Embodiment]

[**0132**] Next, the following is a description on a fifth embodiment of the video retrieval and browsing apparatus. According to this fifth embodiment, thumbnail retrieval and browsing and high precise segment playback by designating the time as playback start/end point are carried out on a local host computer using complexly the telop query described in the above second embodiment and the audio classification data described in the above third embodiment.

[**0133**] In **FIG. 23**, the video retrieval and browsing apparatus has the same configuration as **FIG. 10** excepting a query storage device **67**, a retrieval section **68**, a controller **69** and a search result browser **70**, and is operated in the same manner as that. The query storage device **67** is stored with telop query and audio classification data. The retrieval section **68**, the controller **69** and the search result browser **70** individually include all functions described in the above first and third embodiments.

[**0134**] **FIG. 24** shows an example of a complex browsing display of the telop retrieving browser and the audio classification browser. In **FIG. 24**, the operation of the telop start point time code sequence **49** and the telop start point thumbnail sequence **50** are the same as that of **FIG. 12**. An audio classification data sequence (AC(Tn) AC(Tn+1), AC(Tn+2), AC(Tn+3), AC(Tn+4), . . .) **71** corresponding to the telop start point time code sequence is displayed synchronous with the telop start point time code sequence (Tn, Tn+1, Tn+2, Tn+3, Tn+4) **49** and the telop start point thumbnail sequence (Th(Tn), Th(Tn+1), Th(Tn+2), Th(Tn+3), Th(Tn+4)) **50**. When pushing a left skip button **51**, a time code sequence (Tn−5, Tn−4, Tn−3, Tn−2, Tn−1), a telop start point thumbnail sequence (Th(Tn−5), Th(Tn−4), Th(Tn−3), Th(Tn−2), Th(Tn−1)) and an audio classification data sequence (AC(Tn−5), AC(Tn−4), AC(Tn−3), AC(Tn−2), AC(Tn−1)) before one span of the presently displaying time code sequence are displayed. Likewise, when pushing a right skip button **52**, a time code sequence (Tn+5, Tn+6, Tn+7, Tn+8, Tn+9), a telop start point thumbnail sequence (Th(Tn+5), Th(Tn+6), Th(Tn+7), Th(Tn+8), Th(Tn+9)) and an audio classification data sequence (AC(Tn+5), AC(Tn+6), AC(Tn+7), AC(Tn+8), AC(Tn+9)) after one span of the presently displaying time code sequence are displayed. In this case, the audio classification data AC(Tn) in the telop start point time Tn is obtained from ACm (m audio classification data) shown in the following equation (7) using m (m audio classification point) satisfying the following equation (6).

$$Am \leqq Tn < Am+1 \tag{6}$$

$$AC(Tn)=ACm \tag{7}$$

[**0135**] **FIG. 25** shows a video index browser and video player complexly using the telop retrieval point browser, the audio classification browser and the frame unit browser.

[**0136**] A telop retrieval and audio classification complex browser **72** is operated in the same manner as **FIG. 24**, and displays a scene changing point such as news by the telop start point using thumbnail and audio classification data, and can designate playback start and end positions. In a state that a thumbnail of certain time position is selected on the telop retrieval and audio classification complex browser **72**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. Subsequently, when pushing the playback start button **45**, segment playback from the start point to end point designated by the telop start point is started on the playback display screen **46**. In the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back.

[**0137**] The operation of the equal interval browser **39** making the frame unit display is the same as the above first embodiment; therefore, the details are omitted.

[**0138**] [Sixth Embodiment]

[**0139**] Next, the following is a description on a sixth embodiment of the video retrieval and browsing apparatus. According to this sixth embodiment, thumbnail retrieval and browsing is carried out using complexly the cut point query described in the first embodiment, the telop query described in the above second embodiment and the audio classification data described in the above third embodiment. Further, high precise segment playback by designating the time as playback start/end point is carried out on a local host computer.

[**0140**] In **FIG. 26**, the video retrieval and browsing apparatus has the same configuration as **FIG. 1** excepting a query storage device **73**, a retrieval section **74**, a controller **75** and a search result browser **76**, and is operated in the same manner as that. The query storage device **73** is stored with cut point query, telop query and audio classification data. The retrieval section **74**, the controller **75** and the search result browser **76** individually include all functions described in the above first to third embodiments.

[**0141**] **FIG. 27** shows an example of a video index browser and video player complexly using the cut point retrieval browser, the telop retrieval browser, the audio classification browser and the frame unit browser.

[**0142**] A cut point retrieval, telop retrieval and audio classification complex browser **77** selects a retrieval and browsing method (cut point retrieval, telop retrieval, audio classification browsing) in a retrieval and browsing method extract menu **79**, and thereby, each operation of an internal browsing display section **78**, a left skip button **36** and a right skip button **37** is changed.

[0143] In the operation of the internal browsing display section **78** in each retrieval and browsing method, cut point retrieval is the same as **FIG. 21**, telop retrieval is the same as **FIG. 24**, and audio classification browsing is the same as **FIG. 17**.

[0144] In a state that a thumbnail of certain time position is selected on the cut point retrieval-telop retrieval-audio classification complex browser **77**, when pushing the playback start time point button **42**, the time code is displayed on the playback start point display area **41** while the corresponding thumbnail being displayed on the playback start time point button **42**. In the case of making fine adjustment of frame unit of the playback start point, frame skip buttons **82** and **83** are used. Likewise, when pushing the playback end time point button **44**, the time code is displayed on a playback end point display area **43** while the corresponding thumbnail being displayed on the playback end time point button **44**. In the case of making fine adjustment of frame unit of the playback end point, frame skip buttons **84** and **85** are used. Subsequently, when pushing the playback start button **45**, segment playback from the start point to end point designated by the cut point, telop start point and the audio classification changing point is started on the playback display screen **46**. In the case where the playback start button **45** is pushed in a state of designating only playback start position, the segment playback from the designated start point to the last of contents is carried out. On the other hand, in the case where the playback start button **45** is pushed without designating the playback start and end position, the whole segment from the head to last of the video contents is played back. The operation of edit segment addition button **86** will be described in the following eighth embodiment.

[0145] The operation of the equal interval browser **39** making the frame unit display is the same as the above first embodiment; therefore, the details are omitted.

[0146] [Seventh Embodiment]

[0147] Next, a seventh embodiment of the present invention will be described with reference to **FIG. 28**.

[0148] According to this seventh embodiment, thumbnail retrieval and browsing and high precise segment playback by designating the time as playback start/end point is carried out using complexly the cut point query, the telop query, the audio classification data and frame unit retrieval described in the above first to sixth embodiments. Further, the thumbnail retrieval and browsing and segment playback are applied to server client computer on the network.

[0149] In **FIG. 28, a** video storage device **88** is previously stored with video contents. Various query such as the cut point query, the telop query and the audio classification data are detected from the stored video image, and then, the detected data is saved in a query storage device **87**. In this case, there is no need of extracting and saving browsing thumbnail such as JPEG file corresponding to time codes included in various query. Various retrieval classification data description is the same as the first to sixth embodiments.

[0150] A video file name is designated from a retrieval and playback command input section **98** on client side WWW browser, and various retrieval start commands are inputted to a controller **92** via a network **95** and a WWW server **93**. Whereupon the controller **92** outputs various retrieval and classification start time codes and the number of retrievals of various retrieval and classification browsing thumbnail to a retrieval section **89**. Then, based on the inputted data, the retrieval section **89** obtains a browsing time code sequence corresponding to thumbnail to be browsed from various query stored in the query storage device **87**. The controller **92** transfers the obtained browsing time code sequence to the thumbnail extracting section **90**, and then, the corresponding thumbnail sequence is fetched. Thereafter, the time code is browse-displayed as various retrieval and classification results on the search result browser **97** on the WWW browser **96** via the controller **92**, the WWW server **93** and the network **95**.

[0151] In the case of retrieving, classifying and browsing further detailed contents in a time direction from various retrieval and classification point positions or arbitrary position, a retrieval and playback command input section **98** on the WWW browser **96** inputs the following information to the controller **92** via the network **95** and the WWW Server **93**. More specifically, the information includes time codes of the detailed retrieval, classification and browsing start position, display precision of time directions such as frame unit and second unit, and the number of retrievals of browsing thumbnail. Then, the controller **92** generates a browsing time code sequence having a predetermined time interval from the obtained data, and thereafter, transfers the obtained browsing time code sequence to the thumbnail extracting section **90**. Further, the corresponding thumbnail sequence is fetched, and then, is transferred to the search result browser **97** via the controller **92**, the WWW server **93** and the network **95** so that it is browse-displayed as the retrieval result of predetermined time interval.

[0152] In the case of carrying out video segment playback, a video playback start time code and a video playback end time code are obtained on the browse-display of the search result browser **97** on the WWW browser **96**. Whereupon the retrieval and playback command input section **98** on the WWW browser **96** inputs playback start and end time codes and playback start command data including video file name data to a video server **94** via the network **95**. The video server **94** extracts a segment data designated by frame precision of designated video contents from video content storage **88**, and thereafter, transmits the segment data to a video playback display section **99** on the WWW browser **96** via the network **95**. At that time, if a transmission band of the extracted video exceeds an output network transmission band, a bit amount conversion gateway **91** makes a bit amount conversion so that the transmission band is adaptable to the network transmission band, and thereafter, outputs it. In this case, the video bit amount conversion may be made using the method described in "video coding data rate conversion method and apparatus disclosed in Japanese Patent Application Laid-Open No. 8-251587" by the present applicant. The video playback display section **99** plays back the received data in succession, and thereby, carries out frame precision segment playback from the playback start point to the playback end point.

[0153] The following is a description on the embodiment of actually implementing these devices as system. The controller **92** and the retrieval section **89** are implemented by ASP (Active Server Page, script language such as JavaScript) dynamically adaptable to interactive operation with

the WWW browser **96** via the WWW server **93**. Then, the thumbnail extracting section **90** implemented by library module accessible from ASP such as ATL (Active Template Library) is controlled from the ASP of the controller **92**. In order to achieve high-speed retrieval, the query storage device **87** stores the query in database, and makes a retrieval request from the ASP of the retrieval section **89** in the format of SQL using an ODBC (Open Database Connectivity) function. The video storage device **88** preferably uses an HDD having RAID (Redundant Arrays of Inexpensive Disks) configuration in view of improving performance when a large number of random accesses is simultaneously made from the video server **94** and the thumbnail extracting section **90**.

[**0154**] The first to seventh embodiments have described with reference to the accompanying drawings. However, the detailed configuration is not limited to the above first to seventh embodiments.

[**0155**] For example, in the above first to seventh embodiments, a thumbnail extracting program is recorded in a computer readable recording medium as shown in **FIG. 42**, and then, a computer **200** shown in **FIG. 42** may read and execute the thumbnail extracting program recorded in a recording medium **300**. In this case, the thumbnail extracting program is a program for realizing the function of the thumbnail extraction section shown in **FIG. 1**, **FIG. 3**, **FIG. 10**, **FIG. 15**, **FIG. 20**, **FIG. 26** and **FIG. 28**.

[**0156**] The computer **200** shown in **FIG. 42** comprises a CPU **201**, an input device **202** such as keyboard and mouse, a ROM (Read Only Memory) **203**,a RAM (RandomAccess Memory) **204**, a reader **205**, an output device **206** such as display and printer, and a bus (BUS) connecting each device. More specifically, the CPU **201** executes the above transmission program, and the ROM **203** stores various data. Further, the RAM **204** stores operation parameters, and the reader **205** reads a transmission program from the recording medium **300**.

[**0157**] The CPU **201** reads the thumbnail extracting program recorded in the recording medium **300** via the reader **205**, and thereafter, executes the read thumbnail extracting program, and thereby, the above thumbnail extracting process is carried out.

[**0158**] As is evident from the above description, in the video retrieval and browsing apparatus of the present invention, it is possible to achieve low resource retrieval and browsing by extracting the thumbnail in real time, and to achieve high and effective retrieval and browsing on various video content base. Therefore, the following effects can be obtained.

[**0159**] (1) Thumbnail retrieval and browsing is carried out using the query (e.g., cut point time code) such as cut point detected from the video contents such as MPEG stored in the storage device, and then, the thumbnail data required for browse-display is extracted from the video contents. By doing so, it is possible to realize thumbnail retrieval and browsing without previously preparing and saving thumbnail data. Further, it is possible to realize high-precise thumbnail retrieval and browsing at frame unit and second unit.

[**0160**] (2) The browsing time of the thumbnail retrieval and browsing is designated as playback start point and end point, and thereby, high-precise segment playback can be achieved.

[**0161**] (3) The cut point query, query by telop such as news, and audio classification data are employed as query used for the above thumbnail retrieval and browsing, and thereby, various thumbnail retrieval and browsing can be achieved.

[**0162**] (4) It is possible to achieve designated segment playback using the time of the thumbnail retrieval and browsing of the above item (3) as playback start point and end point.

[**0163**] (5) The cut point retrieval, telop retrieval, audio classification retrieval and equal interval retrieval such as frame unit retrieval are complexly combined, and thereby, it is possible to hierarchally and effectively achieve retrieval and browsing from rough outline grasping retrieval to fine time direction retrieval.

[**0164**] (6) The processing from the above items (1) to (5) is not only carried out on the local host computer, but also is carried out on the network in a state of having video data in common.

[**0165**] (7) The program recorded in the recording medium is read into the computer, and thereby, the present invention can be realized on computers such as personal computers.

[**0166**] Next, the following is a description on an eighth embodiment of the present invention. According to this eighth embodiment, edit start/end points are effectively accurately designated using thumbnail retrieval and browsing result using cut point retrieval, telop retrieval, audio classification retrieval and frame unit retrieval described in the above first to sixth embodiments, and then, video edit is carried out.

[**0167**] In **FIG. 29**, each operation of the thumbnail extracting section **14**, the search result browser **76** and the video storage device **12** is the same as **FIG. 26**. The search result browser **76** finds frame-precision edit start/end points out of the retrieval or search result such as the cut point retrieval, telop retrieval, audio classification retrieval and frame unit retrieval, thumbnail-browsed, and then, inputs the time codes and file name to the controller **102** via an edit segment adding command input section **104**. The controller **102** extracts the edit start/end points and the thumbnail having content head time code from the thumbnail extracting section **14** together with the added edit segment time code, and thereafter, additionally transmits it to an edit list display section **105**. The edit segment adding operation is repeatedly made, and thereafter, in order to check visual consistency of each edit point (each joint portion) in video playback, confirmation is carried out by splice edit (partial edit of joint portion) and splice playback (partial playback of joint portion).

[**0168**] The splice edit/playback processing will be described below. A splice playback command input section **106** inputs to the splice edit section **101** a splice playback command (partial playback of joint portion) together with a file name of content corresponding to an edit point and edit start/end point via the controller **102**. Whereupon the splice edit section **101** reads a data equivalent to a predetermine

time (e.g., 3 seconds, changeable by setup) before and after the edit point from the corresponding video content, and then, edits it partially. Subsequently, a splice playback section **103** plays back the partially edited video data, and thereafter, displays it on a splice view **108**.

[**0169**] Unnecessary edit segment is deleted by splice playback confirmation, and an edit segment requiring a change is finely adjusted. Finally, all edit segments and all joint portions are confirmed in their consistency, and thereafter, an edit start command input section **107** outputs an edit start command, and thereby, the video content is edited.

[**0170**] Next, the following is a description on frame unit edit of MPEG content in a frame unit edit section **100**. As shown in **FIG. 30**, the edit processing is made as compressed data is unchanged except that a base band edit section **109** partially decodes the edit point former half **110** and the edit point latter half **111**, and carries out edit and re-compression. Therefore, it is possible to prevent degradation of picture quality, to reduce a temporary saving disk for avoiding the entire decoding, and to achieve high speed processing.

[**0171**] A frame unit editing method on MPEG compressed data will be detailedly described below with reference to FIG. **31** to **FIG. 38**. In these figures, the frame display array is all display order. The difference between display order and stream order is as shown in **FIG. 31**; more specifically, frame array on MPEG-compressed stream is stream order, and frame array after being decoded and played-back is display order.

[**0172**] **FIG. 32** shows the case where the edit point former half is cut after a P frame **112**, and the edit point latter half is cut just before a P frame **113**. In the edit point former half portion, a bit distribution of all frames (equivalent to **110**) before the P frame **112** in the same GOP including the P frame **112** is changed. On the other hand, in the edit point latter half portion, a bit distribution of all frames after the P frame in the same GOP including the P frame **113** and the head two B frames (equivalent to **111**) belonging to the next GOP is changed. In this case, picture type has no change; however, the amount of bit distribution to each frame, that is, quantizer scale is adjusted so that a VBV (Video Buffering Verifier) is not destroyed at the head of stream. Each processing of the edit point former half and the edit point latter half will be detailedly described below.

[**0173**] First, the following is a detailed description on the processing of the edit point former half. **FIG. 33** shows the case where the edit point former half is cut after an I frame **114**. In the edit point, the GOP is closed; for this reason, a picture type of the I frame **114** is changed into a P frame **115**, and bit distribution is changed in a state that the picture type of all frames belonging to the GOP before one is unchanged as it is. In the case of changing the I frame into the P frame, the I frame is once decoded, and thereafter, is re-coded as P frame. However, in this case, the P frame usually has a bit amount of a few of the I frame; for this reason, the bit amount generated by that the I frame is changed to P frame is redistributed to the remaining frame of GOP.

[**0174**] **FIG. 34A** shows the case where the edit point former half is cut after a P frame **116**. A picture type of the P frame **116** is unchanged, and the bit amount of all frames (equivalent to **110**) before the P frame **116** in the same GOP including the P frame **116** is redistributed. In this case, B frames B**28** and B**29** having a bit amount considerably less than the P frame are deleted; therefore, the bit amount is less redistributed so that the P frame connects with the I frame of the next GOP, and buffer underflow is not generated.

[**0175**] However, in **FIG. 34B** showing the case where the edit point former half is cut after the same P frame, the edit point is positioned at the former half of GOP, and bit distributing operation is difficult in the same GOP; for this reason, the bit redistribution is carried out including the GOP before one. In this case, I**16** is changed to P'**16** in its picture type, and thereby, the GOP structure having 15-frame configuration can be changed to a GOP structure having 21-frame configuration.

[**0176**] **FIG. 35A** shows the case where the edit point former half is cut after a B frame **117**. The B frame **117** is changed to a P frame in its picture type, and the bit amount of all frames (equivalent to **110**) before the B frame **117** of the same GOP including the B frame **117** is redistributed. In the case of changing the B frame to the P frame in its picture type, basically, the B frame is once decoded, and then, is re-encoded as P frame. In macro block carrying out motion compensation of only forward direction in the B frame, even if the B frame is changed to the P frame, the same direction motion compensation is carried out. For this reason, a motion vector is intactly used, and then, re-encoding is carried out, and thereby, it is possible to improve a processing speed as compared with the case of newly carrying out motion search processing with respect to the entire MB.

[**0177**] In **FIG. 35B** showing the case where the edit point former half is cut after the same B frame, the edit point is positioned at the former half of GOP, and the bit distributing operation is difficult in the same GOP; for this reason, bit redistribution is carried out including the GOP before one. In this case, I**18** is changed to P'**18** in its picture type, and thereby, the GOP structure having 15-frame configuration can be changed to a GOP structure having 20-frame configuration. In the case of making a change from B**19** to B'**19**, the bit distribution is changed, and in addition, a reference frame used in backward motion compensation is changed from P**21** to P'**20**. For this reason, in MB using bi-directional motion compensation or backward motion compensation, a motion vector must be again searched.

[**0178**] The processing of the edit point former half has been described above. Next, the processing of the edit point latter half will be detailedly described below. **FIG. 36** shows the case where the edit point latter half is cut after an I frame **119**. A bit distribution change of all frames after the I frame **119** of GOP including the I frame **119** and the head B frames B**31** and B**32** (equivalent to **111**) belonging to the next GOP is carried out.

[**0179**] **FIG. 37A** shows the case where the edit point latter half is cut just before a P frame **120**. Since a new GOP starts at the edit point, the P frame **120** is changed to an I frame **121** in its picture type, and a bit distribution of all frames after the P frame **120** included in the same GOP and the head B frames B**16** and B**17** (equivalent to **111**) belonging to the next GOP is carried out. In the case of changing the P frame to the I frame, the P frame is once decoded, and then, is re-encoded as I frame. In this case, the I frame usually has a bit amount of several times as much as the P frame. For this reason, in the remaining frame of the GOP, the bit amount

generated by that the P frame is changed to the I frame is redistributed so that the increased bit amount can be absorbed. However, in **FIG. 37B** showing the case where the edit point latter half is cut just before the same P frame, the edit point is positioned at the latter half of GOP, and the bit distributing operation is difficult in the same GOP. For this reason, the bit redistribution is carried out including the head two B frames belonging to the next GOP and another next GOP. In this case, P**15** is changed to I'**15** in its picture type, and thereby, the GOP structure having 15-frame configuration can be changed to a GOP structure having 16-frame configuration.

[**0180**] **FIG. 38A** shows the case where the edit point latter half is cut just before a B frame **122**. Since a new GOP starts at the edit point, the I frame is required in the vicinity of the head position; for this reason, the frame P**6** is changed the frame I'**6** in its picture type. Consideration is made such that the B frame **122** is changed to I frame in its picture type; however, Conversion from B frame to I frame is not suitable because the I frame has a large bit amount, and is used as reference image requiring a picture quality. In other frames, a bit mount of all frames after the B frame **122** of the same GOP including the B frame **122** and the head B frames B**16** and B**17** (equivalent to **111**) belonging to the next GOP is redistributed. In conversion from B**4** to B'**4** and from B**5** to B'**5**, the bit amount is adjusted, and in addition, there is no reference I**3** frame for forward motion compensation; for this reason, in MB using bi-directional or forward motion compensation, the motion vector must be again searched.

[**0181**] In **FIG. 38B** showing the case where the edit point former half is cut just before the same B frame, the edit point is positioned at the later half of GOP, and the bit distributing operation is difficult in the same GOP. For this reason, bit redistribution is carried out including the head two B frames (equivalent to **111**) of the next GOP and further next GOP. In this case, I**18** is changed to P'**18** in its picture type, and thereby, the GOP structure having 15-frame configuration can be changed to a GOP structure having 17-frame configuration. In the case of making a change from B**14** to B'**14**, the bit distribution is changed, and in addition, there is no reference frame P**12** used for forward motion compensation; for this reason, in MB using bi-directional motion compensation or forward motion compensation, a motion vector must be again searched.

[**0182**] Next, the following is an example of a description on a screen used in carrying out frame unit edit using video thumbnail retrieval and browsing result. The screen is a video index browser and video player complexly using the cut point retrieval browser, the telop retrieval browser, the audio classification browser and the frame unit browser described in **FIG. 27**. First, in the video index browser and video player, when pushing an edit segment adding button **86** using of playback start time/playback end time of the designated and confirmed segment playback as edit start/end point, the edit start/end point is added as edit segment to a segment (e.g., segment **1**) extracted by a segment extracting button **123** of edit control screen (see **FIG. 39**).

[**0183**] In a representative thumbnail display area **124**, a thumbnail Th(t top1) of the time t top1 (t top1=0: the top of content) representative of inserted video content is displayed. In a file name display area **125**, the file name of the content is displayed. Edit start point thumbnail Th(t in1), edit start point time code (t in1), edit end point thumbnail Th(t out1) and edit end point time code (t out1) are displayed in an edit start point thumbnail display area **126**, an edit start point time code display area **127**, an edit end point thumbnail display area **128** and an edit end point time code display area **129**, respectively. By repeating the same operation as described above, edit segment is added by the segment n.

[**0184**] In the case where the edit segment list is not displayed at one time, a left skip button **130** and a right skip button **131** are pushed, and thereby, the next edit segment is displayed. Further, In the case of deleting an edit segment, a segment delete button **134** is pushed in a state of extracting the segment to be deleted. Further, in the case of finely adjusting the edit start/endpoints of the segment, a segment change button **135** is pushed in a state of extracting the segment, and thereby, the thumbnail and time code of the corresponding edit segment is displayed at the playback start time point/playback end time point as shown in **FIG. 27** to be finely adjusted it again.

[**0185**] In **FIG. 39**, all edit segments are inserted, and thereafter, in the case of confirming visual consistence of the edit point before carrying out edit operation, the following operation is made. More specifically, when pushing a splice view display button **132** of the edit point to be confirmed, and thereby, the joint portion is partially edited from the data before and after the edit point for a short time, and is video-displayed on a splice view **133**. After confirming the consistence of the joint portion of the edit point by the splice view, correction is made in succession if delete and change of the edit segment is necessary. Finally, at the point of time when all edit segments are confirmed, an edit start button **137** is pushed in order to start an edit work. The progress of edit processing is displayed by an edit processing indicator **138**.

[**0186**] In edit starting, when a check is made to an EDL addition button **136**, as shown in **FIG. 40**, the edit segment list is outputted as an EDL (Edit Decision List) file **139** conformable to SMPTE (Society of Motion Picture & Television Engineer) together with video edition. Further, the EDL file is read from the outside, and thereby, it is possible to replay past edit operation, and to fetch and edit the edit list prepared using VTR from the outside. This process is effective as the method of doing an edit work using only edit list without exchanging a large capacity video content in carrying out edit work between remote places.

[**0187**] Next, the following is a description on a ninth embodiment of the present invention. According to this ninth embodiment, frame unit edit using the video thumbnail retrieval and browsing result described in the above eighth embodiment is applied to server client configuration on network.

[**0188**] In **FIG. 41**, each operation of the thumbnail extracting section **90**, the search result browser **97** and the video storage device **88** is the same as that of **FIG. 28**. In the search result browser **97**, frame precision edit start/end points are found from the retrieval results such as browsed thumbnail, cut point retrieval, telop retrieval, audio classification and frame unit retrieval. Then, the time code and file name is inputted to a controller **142** from an edit segment adding command input section **146** via a network **144** and a WWW server **143**.

[**0189**] The controller **142** extracts a thumbnail having edit start/end points and content head time code from the thumb-

nail extracting section **90** together with the added edit segment time code, and then, additionally displays it on an edit list display section **147** via the WWW server **143** and the network **144**. The edit segment adding operation is repeated, and thereafter, in order to check visual consistence of video playback of each edit point (each joint portion), the video playback is confirmed by splice edit (partial edit of joint portion) and splice playback (partial playback of joint portion) via the network.

[**0190**] The splice edit/playback processing via network will be described below. First, a splice playback command input section **148** inputs a splice playback (partial playback of joint portion) command together with the file name and edit start/end points of the content corresponding to the edit point by a splice edit section **141** via the network **144**, the WWW server **143** and the controller **142**. Whereupon the splice edit section **141** reads data having a predetermined time (e.g., 3 seconds, changeable by setup) before and after the edit point from the corresponding video content, and thereafter, partially edits it. Subsequently, the partially edited video data is transmitted to a splice playback section **145** via the WWW server **143**, and thereafter, is played back and displayed on a splice view **150**.

[**0191**] Unnecessary edit segments are deleted by splice playback confirmation; on the other hand, edit segments requiring a change are finely adjusted. The consistence of all edit segments and all joint portions is finally confirmed, and thereafter, the edit start command input section **149** outputs an edit start command to the controller **142** via the network **144** and the WWW server **143**, and thereby, the frame unit edit section **140** executes edit processing of video content.

[**0192**] By doing so, it is possible to effectively retrieve, browse and edit the video image and to make a confirmation before edit by splice view from remote places via the network. Further, the edited video can be confirmed and played back in the retrieval, browsing and playback system on the network described in the above seventh embodiment.

[**0193**] The eighth and ninth embodiments of the present invention have been described above with reference to the accompanying drawings. The detailed configuration is not limited to these eighth and ninth embodiments, and the present invention may include various changes in design within the scope of the present invention without diverging from the gist thereof.

[**0194**] For example, in the eighth and ninth embodiments of the present invention, the following manner may be carried out. More specifically, the thumbnail extracting program of the thumbnail extracting sections **14** and **90**, the frame unit edit program of the frame unit edit sections **100** and **140**, and the splice edit program of the splice edit sections **101** and **141** are recorded in the computer readable recording medium **300** shown in **FIG. 42**. Then, the computer **200** shown in **FIG. 42** reads these thumbnail extracting program, frame unit edit program and splice edit program recorded in the recording medium **300**, and thereafter, may execute these programs. In this case, these thumbnail extracting program, frame unit edit program and splice edit program are programs for realizing each function of the thumbnail extracting section, the frame unit edit section and the splice edit section, which are shown in **FIG. 29** and **FIG. 41**.

[**0195**] In the computer **200** shown in **FIG. 42**, the CPU **201** reads the thumbnail extracting program recorded in the recording medium **300** via the reader **205**, and thereafter, executes these thumbnail extracting program, frame unit edit program and splice edit program. By doing so the above-mentioned thumbnail extracting processing, frame unit edit processing and splice edit processing are carried out. The recording medium **300** includes portable recording medium such as optical disk, floppy disk, hard disk, and in addition, includes transmission medium such as network, which temporarily records and holds data.

[**0196**] As is evident from the above description, in the video retrieval, browsing and editing apparatus of the present invention, the following effects can be obtained.

[**0197**] (1) It is possible to effectively and accurately designate the edit start/end points using the cut point retrieval, the telop retrieval, the audio classification and the frame unit retrieval, and thereby, to achieve video frame unit edit.

[**0198**] (2) In the case of carrying out the frame unit edit processing of MPEG content, the edit processing is carried out in a state of unchanging compressed data except that only partial data before and after the edit point is decoded to base band, and then, is re-compressed. Therefore, it is possible to prevent degradation of picture quality, to reduce a temporary saving disk by non-execution of the entire decoding, and to realize high-speed processing.

[**0199**] (3) The confirmation by splice edit (partial edit of joint portion) and splice playback (partial playback of joint portion) is carried out, and thereby, it is possible to check visual consistence of video playback of each edit point (joint portion) before carrying out video frame unit edit.

[**0200**] (4) In editing the video, the edit segment list is outputted as EDL file conformable to SMPTE (Society of Motion Picture & Television Engineers), and is read out of the outside. By doing so, it is possible to do a new edit work based on the past edit operation, and to fetch and edit the edit list prepared using the VTR from the outside. Further, in the case where edit work is done at remote place, it is possible to instruct the edit work using only edit list from the remote place without making the exchange of video contents.

[**0201**] (5) It is possible to carry out the processings described in the above items (1) to (4) on the network in a state of having the video data in common, in addition to the local host computer.

[**0202**] (6) It is possible to provide a computer readable recording medium recording the program capable of preventing degradation of picture quality by non-execution of the entire decoding of MPEG content, reducing a temporary saving disk, and realizing high-speed processing.

[**0203**] (7) It is possible to provide a computer readable recording medium recording the program capable of executing frame unit edit and splice edit.

What is claimed is:

1. A video retrieval and browsing apparatus for retrieving and browsing a digital video content such as MPEG, comprising:

time direction retrieval means for carrying out time direction retrieval of video content;

thumbnail extracting means for extracting a thumbnail from the video content in real time based on the retrieval result of the time direction retrieval means; and

search result browser for browse-displaying the retrieval result using the thumbnail extracted by the thumbnail extracting means.

2. The video retrieval and browsing apparatus according to claim 1, wherein the time direction retrieval means carries out retrieval in a state of designating a retrieval start point on time axis using a video cut point query.

3. The video retrieval and browsing apparatus according to claim 2, wherein the search result browser displays a cut point thumbnail sequence having a predetermined number and a cut point time line sequence corresponding to the thumbnail.

4. The video retrieval and browsing apparatus according to claim 1, wherein the time direction retrieval means carries out retrieval in a state of designating a retrieval start point on time axis using a video telop query.

5. The video retrieval and browsing apparatus according to claim 4, wherein the search result browser displays a telop start point thumbnail sequence having a predetermined number and a telop start point time line sequence corresponding to the thumbnail sequence.

6. The video retrieval and browsing apparatus according to claim 1, wherein the search result browser carries out retrieval in a state of designating a retrieval start point on time axis using a video audio classification data.

7. The video retrieval and browsing apparatus according to claim 6, wherein the search result browser displays an audio classification data sequence having a predetermined number, an audio classification point thumbnail sequence and an audio classification point time code sequence corresponding to the thumbnail.

8. The video retrieval and browsing apparatus according to claim 1, wherein the time direction retrieval means designates a retrieval start point on time axis of the video, and carries out retrieval at predetermined intervals such as frame unit and second unit.

9. The video retrieval and browsing apparatus according to claim 2, further including means for carrying out retrieval at further fine time interval using a time position designated on a screen of the search result browser as a new retrieval start point.

10. The video retrieval and browsing apparatus according to claim 9, wherein the search result browser displays a frame unit thumbnail sequence having a predetermined number and a frame unit time line sequence corresponding to the thumbnail sequence.

11. The video retrieval and browsing apparatus according to claim 1, further including a thumbnail cache memory for storing the thumbnail extracted by the thumbnail extracting means,

the same thumbnail being read from the thumbnail cache memory so as to reduce a process of extracting the same thumbnail.

12. The video retrieval and browsing apparatus according to claim 11, wherein when extracting a retrieval result browsing thumbnail from MPEG compressed contents, a GOP (Group of Pictures) including a frame equivalent to the thumbnail to be extracted is fully decoded and saved in the thumbnail cache memory, and thereby, decoding of another frame included in the same GOP is omitted.

13. The video retrieval and browsing apparatus according to claim 1, wherein the video content is stored in a WWW server, and the time direction retrieval means and the thumbnail extracting means is provided in the WWW server.

14. The video retrieval and browsing apparatus according to claim 13, wherein a WWW browser is connected to the WWW server via a network so that the WWW server can carry out video retrieval processing, and the WWW browser can designate retrieval conditions and browse-display the retrieval result.

15. The video retrieval and browsing apparatus according to claim 13, wherein in the case of carrying out segment playback of video content, a bit rate of the video content is converted and outputted in accordance with a network bandwidth when an output network band is narrower than a transmission bit rate of video content such as internet.

16. A computer readable recording medium recording a thumbnail extracting processing program for extracting a thumbnail from a video content in real time based on the given time code sequence.

17. The computer readable recording medium according to claim 16, wherein the thumbnail extracting program includes a process for decoding video based on the given time code sequence, and a process for generating a thumbnail from the decoded video.

18. A video retrieval, browsing and editing apparatus for editing a digital video content such as MPEG, comprising means for designating an edit start point and an edit end point using thumbnail retrieval and browsing result complexly using cut point retrieval, telop retrieval or audio classification and frame unit retrieval.

19. The video retrieval, browsing and editing apparatus according to claim 18, further including means for decoding only partial data before and after the edit point to base band, and editing and re-compressing it in the case of carrying out the frame unit edit processing of MPEG content in a state that the data other than the partial data before and after the edit point is intactly compressed data.

20. The video retrieval, browsing and editing apparatus according to claim 18, further including means for making a confirmation by splice edit (partial edit of joint portion) and splice playback (partial playback of joint portion) in order to check visual consistence of video playback of each edit point (joint portion) before carrying out video frame unit edit.

21. The video retrieval, browsing and editing apparatus according to claim 18, further including:

means for outputting the edit segment list as an EDL (Edit Decision List) file conformable to SMPTE (Society of Motion Picture & Television Engineers) in editing video; and

means for reading the EDL from the outside and taking over the editing operation.

22. The video retrieval, browsing and editing apparatus according to claim 18, wherein all processings are carried out using WEB via network.

23. A computer readable recording medium recording a program for decoding only partial data before and after the edit point designated using the thumbnail retrieval and

browsing result to base band, editing it at the edit point, and re-compressing the decoded data in the case of carrying out the frame unit edit processing of MPEG content.

24. A computer readable recording medium recording a splice edit and playback processing program for confirming a visual consistence of joint portion in each edit point before carrying out the edit processing.

25. A computer readable recording medium recording a processing program capable of inputting and outputting an edit segment list as an EDL (Edit Decision List) file conformable to SMPTE (Society of Motion Picture & Television Engineers) in editing video.

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